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A Static World Policy Simulation (SWOPSIM) Modeling Framework

Vernon Oley Roningen

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ABSTRACT

This report documents a framework that can be used to create static world world policy simulation (SWOPSIM) models. The framework consists of a simple economic structure which includes summary policy measures plus a set of computer programs which generates the models from a master model spreadsheet. The models created by the framework reside in spreadsheets and are modified and solved as spreadsheets. SWOPSIM models are designed to simulate the effect of changes in policies on production, consumption, and trade. The framework allows the construction of static single product as well as multi-product world models. Economic linkages across products can occur via cross price relationships and "input-output" product specification while linkages across countries and regions take place through domestic-international price equations and world trade. The use of the SWOPSIM framework is illustrated with a simple world agricultural trade model.

Keywords: Supply, demand, policies, trade, simulation model, trade model.

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A Static World Policy Simulation (SWOPSIM) Modeling Framework

Vernon Oley Roningen

OVERVIEW OF THE STATIC WORLD POLICY SIMULATION (SWOPSIM) MODELING FRAMEWORK

This report documents a framework for creating static world policy simulation (SWOPSIM) models. The framework consists of a simple economic structure along with a procedure for the creation of SWOPSIM models in spreadsheets. The framework allows a researcher to readily set up and parameterize static models in spreadsheets which can be used to examine a variety of policy related topics including trade liberalization and major changes in domestic policies that might have international repercussions.

The report begins with a brief description of the structure used for SWOPSIM models. The models are static, meaning that the dynamic path of endogenous variables such as quantities and prices is not modeled. Simple constant elasticity behavioral equations describe supply and demand in terms of own and cross prices. Input-output types of relationships are also allowed in order to deal with derived demand and joint products. Net trade is a residual for any country/region but is made to balance for the world as a whole via a world market clearing mechanism. The policy stucture relies on the summarization of policies as "subsidy equivalents" on production, consumption, or trade and/or on the concept of price transmission between domestic and international markets. The models are designed to explore the implications of changes in policies from a base equilibrium situation.

SWOPSIM models are created and updated by a sequence of computer programs. A master model file (spreadsheet) defines the view of the world that is to be modeled. Data spreadsheets for each country/region in the world are created from the specification provided in a master file. As base data or elasticities are added to, or modified in the country/region spreadsheets, updated equations can be placed in the proper cells. Once all of the country/region spreadsheets are created and initialized with data, parameters, and equations, a world product model can be created for any selected product. Finally, a full world multi-product SWOPSIM model is created. This model can be used to explore the entire set of cross country and cross product responses expected from significant policy changes. Such a model can be used, for example, to explore the full ramifications of trade liberalization in agriculture.

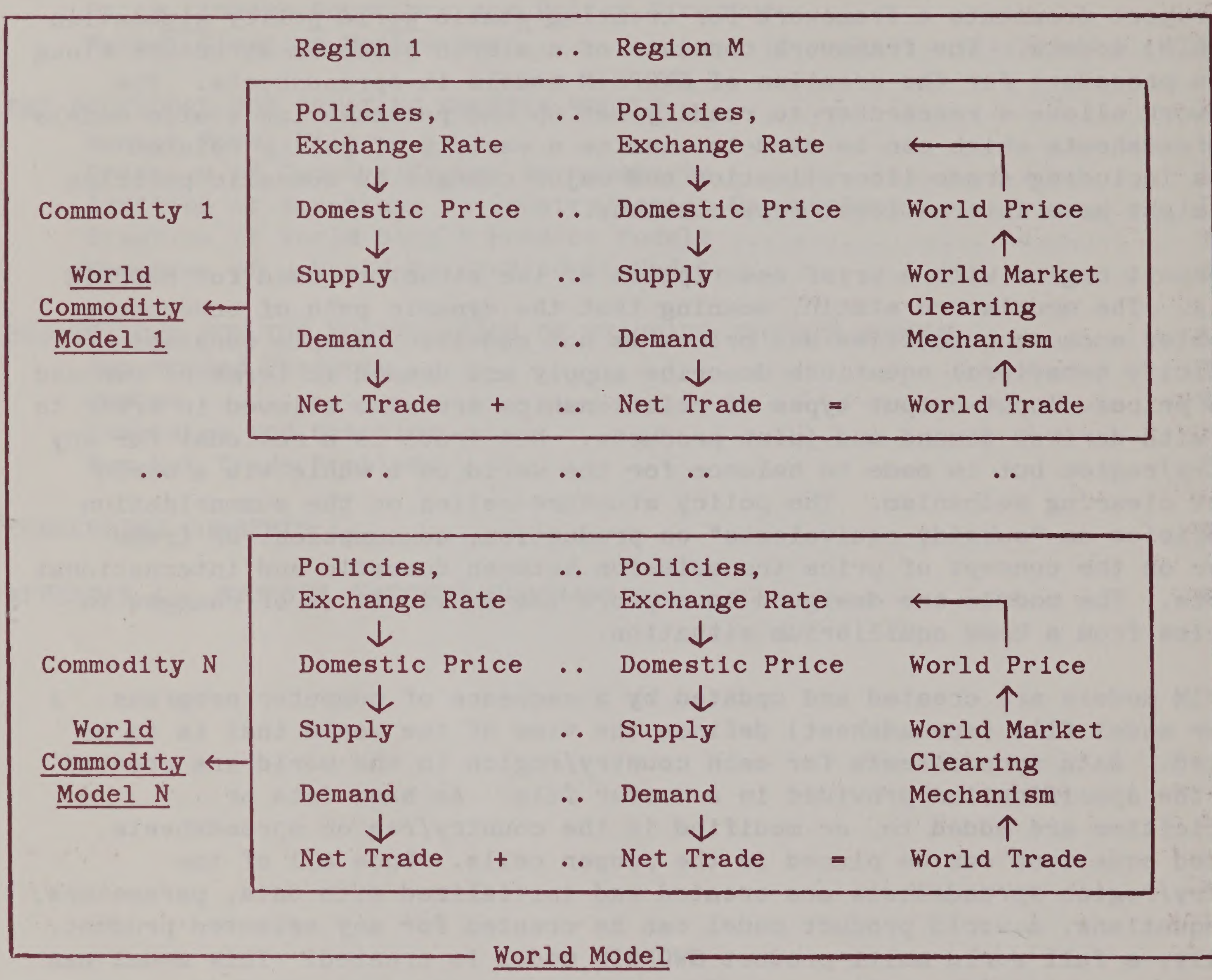
The report concludes with suggestions for the modification of standard SWOPSIM models. Appendix A includes a full documentation of all of the programs used to create SWOPSIM models.

The SWOPSIM framework is a research tool which is designed to free the researcher from some of the dreariness of model building and therefore allow more time for the application of economic logic to the analytical task.

THE STRUCTURE OF SWOPSIM MODELS

A simple standard structure is used for model components. Policy, price, supply, demand, and net trade equations are specified for a country/region. These components are combined across products to form operational world single product models. Single product models combined form a full world multi-product model (see figure 1).

Figure 1--Structure of SWOPSIM Models



Behavioral Equations

SWOPSIM models are static; they do not model the time paths of endogenous variables. Instead, they solve for values at the end of a time period which is defined by the parameterization of the model. Comparative static models are designed to compare alternative equilibrium states disregarding the process of adjustment which leads to the equilibrium state. If, for example, a static model contains long-term own and cross price elasticities, it can be viewed as a longrun static version of a dynamic model. The static model calculates the ultimate changes that would be expected to work themselves out

over several time periods in the dynamic model.

Simple standard equations are created for SWOPSIM models. Supply and demand quantities are functions of own and cross product prices, and if desired, other supply and demand quantities included in a model. Constant elasticity functional forms are used. Trade is the difference between supply and demand. Stocks are not explicitly included in the standard specification.

As an example, suppose a model includes beef (BF), wheat (WH), and corn (CN). Let P denote a price, QS the quantity supplied, QD the quantity demanded, QT the quantity traded, SF a shift factor (a value of 0 means no shift), S a supply related variable, D a demand related variable, and C a constant. A set of supply demand and trade equations might appear as follows (* means times and ^ means exponentiation):

$$QSCN = (1 + SFSCN) * CSCN * (PCN \hat{} .3) * (PWH \hat{} -.2) \tag{1}$$

$$QDCN = (1 + SFDCN) * CDCN * (PCN \hat{} -.2) * (PWH \hat{} .05) * (QSBF \hat{} .1) \tag{2}$$

$$QTCN = QSCN - QDCN \tag{3}$$

The shift factors allow exogenous supply and demand shifts to be explored with the static model. An explanation follows concerning the use of input-output direct linkages that can be used for the specification of joint production or derived demand [as illustrated by putting the beef supply quantity as a feed demand variable in the corn demand equation (2) above].

Equations of the above form are used as standard SWOPSIM behavioral equations. If equations are needed that differ from this standard form, they can be modified manually for individual products. The constant elasticity form was chosen for the standard equations because it is easy to interpret and may avoid some types of model solution problems.

Derived Demand

For some products such as livestock feed, the demand depends not only on prices, but also on some physical relationship which relates an input (e.g. feed demand) to an output (e.g. meat production). A derived demand relationship should reflect both price and physical relationships. A SWOPSIM model can be specified to reflect this "input-output" relationship as follows: Adding to the notation for equations (1)-(3), let corn (CN) and wheat (WH) be fed to beef cattle (BF) and hogs (PK) in the quantities QDCNBF and QDCNPK, respectively. Assume that the ratio of corn fed to meat supplied is a function of relative prices:

$$QDCNBF/QSBF = A1 * (PCN \hat{} B1) * (PWH \hat{} C1) \tag{4}$$

$$QDCNPK/QSPK = A2 * (PCN \hat{} B2) * (PWH \hat{} C2) \tag{5}$$

A1 and A2 are intercept terms and B1, C1, B2, and C2 are demand elasticities. Further assume that the rate of substitution for the same feed in response to price is the same for the two meats (this does not mean that the feed mixes are the same for the two meats). This assumption implies that B1 = B2 = B and C1 = C2 = C. Letting • denote percentage change, the total feed demand for corn can be written:

$$QDCN = QDCNBF + QDCNPK$$
$$= (PCN \wedge B) * (PWH \wedge C) * [(A1 * QSBF) + (A2 * QSPK)] \tag{6}$$

With this specification, the elasticity of QDCN with respect to QSBF is:

$$(\bullet QDCN/\bullet QSBF) = (PCN \wedge B) * (PWH \wedge C) * A1 * QSBF / QDCN \tag{7}$$

Substituting equation (4) into equation (7) yields:

$$(\bullet QDCN/\bullet WSBF) = QDCNBF/QDCN \tag{8}$$

This means that a derived demand can be approximated in a constant elasticity specification by including the supply quantity (using the product) as a variable in the demand equation where the share of the product demanded for producing the supply serves as the constant elasticity. Thus in equation (2), corn (CN) is assumed to be fed to beef with a historical share of total corn demand going to beef production of 10 percent [the elasticity of the beef supply variable in equation (2)]. This specification can be used for every use of a product as an input to the production of another product. For example, if corn was also fed to poultry, equation (2) would include another term (the quantity supplied of poultry meat) with an elasticity representing the share of total corn demand going to feed poultry. 1/

Joint Products

Many products are produced jointly from one base product with the yield ratios being determined by quantity relationships and sometimes being influenced by relative prices of the products. Examples are the production of meal and oil by crushing soybeans and the production of butter (BT), cheese (CH), and fluid milk (FM) from dairy farm milk (MK).

Assuming the possibility of substitution among products in response to price and assuming that the total demand for milk (QDMK) is for the production of butter, cheese, and fluid milk, three supply equations can be written:

$$QSBT/QDMK = A1 * (PBT \wedge B1) * (PCH \wedge C1) * (PFM \wedge D1) \tag{9}$$

$$QSCH/QDMK = A2 * (PBT \wedge B2) * (PCH \wedge C2) * (PFM \wedge D2) \tag{10}$$

$$QSFM/QDMK = A3 * (PBT \wedge B3) * (PCH \wedge C3) * (PFM \wedge D3) \tag{11}$$

In this specification, it can be shown that the elasticity of a joint product with respect to the total demand of the base product (e.g. QSBT with respect to QDMK) is unity. Therefore the supply equation for a joint product can be represented in constant elasticity form with a demand quantity variable for the base product in the supply equation with an elasticity of unity. For QSBT, this equation would be:

$$QSBT = A1 * (PBT \wedge B1) * (PCH \wedge C1) * (PFM \wedge D1) * (QDMK \wedge 1) \tag{12}$$

1/ This specification was suggested by S. Magiera.

The key problem remaining with joint product specification is the derivation of a demand elasticity for the base product. One way of doing this for the above example where supply elasticities for joint products appear in the supply equations might be as follows: Again let • denote percent change, V denote value, VA value added, ELAS elasticity; then following the notation in equations (9) - (11), the following identity can be written assuming the total value of dairy farm milk production equals the value of the joint product production plus the value going to other inputs (value added):

$$(PBT * QSBT) + (PCH * QSCH) + (PFM * QSFM) + VAMK = PMK * QDMK \tag{13}$$

Differentiating and gathering terms, this produces:

$$\begin{aligned} & VMK * (1-ELASQDMK) * (\bullet PMK) \\ & = VBT * [(1+ELASQSBT) * (\bullet PBT) + ELASQSBTCH*(\bullet PCH) + ELASQSBTFM*(\bullet PFM)] \\ & + VCH * [(1+ELASQSCH) * (\bullet PCH) + ELASQSCHBT*(\bullet PBT) + ELASQSCHFM*(\bullet PFM)] \\ & + VFM * [(1+ELASQSFM) * (\bullet PFM) + ELASQSFMBT*(\bullet PBF) + ELASQSFMCH*(\bullet PCH)] \\ & + VAMK * (1+ELASVAMK) * (\bullet VA) \end{aligned} \tag{14}$$

Canceling out the value added identity, assuming that equation (14) is homogeneous of degree zero in the long run, and solving for the elasticity of demand for milk yields a formula relating this elasticity to the supply elasticties of the joint products and an assumed elasticity of supply of value added (ELASVAMK) which represents the supply elasticity of other factors in the production process. Let VS denote a value share (e.g. VSBTMK = VBT/VMK):

$$\begin{aligned} ELASQDMK = -[& (1-VSBT-VSCH-VSFM) * ELASVAMK \\ & + VSBT * (ELASQSBT + ELASQSBTCH + ELASQSBTFM) \\ & + VSDC * (ELASQSCH + ELASQSCHBT + ELASQSCHFM) \\ & + VSFM * (ELASQSFM + ELASQSFMBT + ELASQSFMCH)] \end{aligned} \tag{15}$$

Equation (15) states that the base product demand elasticity is a weighted sum of the product supply elasticities and an assumed elasticity for the supply of other inputs in the "value added" production process. Such a formula provides an acceptable base product demand elasticity for SWOPSIM's constant elasticity formation.

If product supply elasticities do not appear in the supply equations, the product supply elasticities might appear with positive signs in the base product demand equation along with a negative base product demand elasticity where a similar weighting scheme relates the base product demand and the derived product cross price demand elasticities. This alternative formulation might be appropriate, for example, for the specification of a base product demand equation as a crushing equation for soybeans (increased meal and oil prices encourage crushing while increased soybean prices--a cost--discourage crushing).

Price Linkage Equations and Policy Structure

The policy structure of SWOPSIM models is embedded in equations linking domestic and world prices. The standard policy structure is designed to allow flexibility in characterizing policies that might affect production, consumption, and trade. Policies are inserted as subsidy equivalents at the producer, consumer, export, or import level. Alternatively, price transmission elasticities can be used to characterize the degree of connection

of domestic and world prices. Exchange rates translate world prices to trade prices denominated in a country's domestic currency to link up with producer and consumer prices also denominated in domestic currency.

The standard policy structure found in SWOPSIM models is developed below. As is the case with behavioral equations, price linkage equations and their policy structure can be modified once the standard equations have been created. The basic design premise of the price linkage equations and policy structure is to create a standard yet flexible framework in which linkages and policies can be parameterized. A second important consideration is the desire to <u>minimize</u> the need for base period information for parameterization for a particular country and product and to parameterize equations using the most robust data available. This means that the linkage equations can be parameterized on <u>observed equilibrium data</u> and that policy changes are inserted to <u>remove</u> policies now in place. This design approach means that "harder" observed data and many "unobserved" variables are embedded in the fixed constant terms of a SWOPSIM model. "Softer" policy measurement data are used to shock the model from the observed equilibrium situation.

To begin from a theoretically more complex and "realistic" situation, price and margin variables are defined to describe the base equilibrium situation:

PP Price (Production)
PC Price (Consumption)
PE Price (Export)
PI Price (Import)
MD Margin (Domestic)
ME Margin (Export)
MI Margin (Import)

PW Price (World)
ER Exchange Rate

CE Constant (in Export price linkage equation)
CI Constant (in Import price linkage equation)

Both these constants include transportation costs which drive a wedge between world prices and trade prices in domestic currencies.

TR Transmission elasticity (exchange Rate)
TW Transmission elasticity (World price)

A value of zero for a transmission elasticity means no transmission while a value of one implies full transmission of prices.

Given the above variable definitions, the following equations define the <u>underlined</u> margins and constants:

Domestic margin $\underline{MD} = PC - PP$ (16)

Export margin $\underline{ME} = PE - PP$ (17)

Import margin $\underline{MI} = PC - PI$ (18)

Export price linkage constant $\underline{CE} = PE / [(ER ^\wedge TR) * (PW ^\wedge TW)]$ (19)
Import price linkage constant $\underline{CI} = PI / [(ER ^\wedge TR) * (PW ^\wedge TW)]$ (20)

Policy intervention variables (defined as <u>positive</u> unit value subsidy equivalents) include:

SP Subsidy (Production)
SC Subsidy (Consumption)
SE Subsidy (Export)
SI Subsidy (Import)

Total production and consumption subsidy equivalents (PSE and CSE) would be defined as:

$$PSE = SP + SE - SI \quad (21)$$

$$CSE = SC - SE + SI \quad (22)$$

Taxes or tariffs are simply defined as negative subsidy equivalents. Equations (21) and (22) assume that domestic and foreign products are perfect substitutes so that a "price wedge" imposed at the border is fully transmitted to domestic producers and consumers. The "observed" base prices are assumed to reflect the impact of any policies in place. The two price linkage equations--(19) and (20)--can be simplified to one equation applicable for both exports and imports. Combining equations (17) and (19):

$$PP = -ME + CE * (ER ^\wedge TR) * (PW ^\wedge TW) \quad (23)$$

Combining equations (16), (18), and (20):

$$PP = PC - MD = PI + MI - MD = MI - MD + CI * (ER ^\wedge TR) * (PW ^\wedge TW) \quad (24)$$

Just one equation can be used to replace equations (19) and (20) if it is assumed that -ME = MI - MD and that CE = CI. The former assumption (MD = MI + ME) implies a costless transition between exporting and importing for a product. A product can be marketed domestically with the same margin for exporting (MI = 0) or for importing (ME = 0) or the re-export of an import (MI + ME). Define MA and CT for this simplification:

$$MA = -ME = MI - MD \quad (25)$$

$$CT = CE = CI \quad (26)$$

Equation (26) implies equal transport costs and margins, etc. from port to foreign supply sources or customers. Using these two assumptions, only two price linkage equations remain:

<u>Production price linkage</u> $PP = MA + CT * (ER ^\wedge TR) * (PW ^\wedge TW)$ (27)

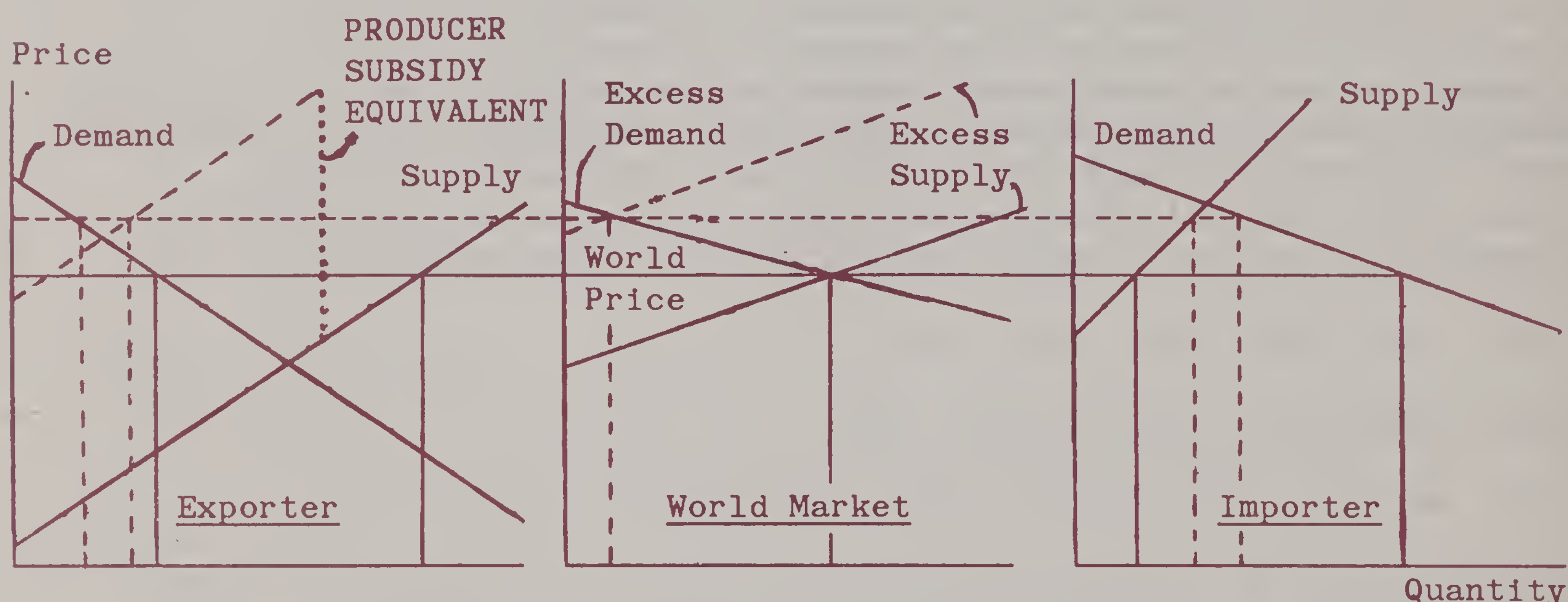
<u>Consumption price linkage</u> $PC = MD + PP$ (28)

MD can be calculated by observing the base prices PC and PP. CT must be calculated by first calculating CE or CI from equation (19) or (20), whichever applies. This requires a trade price (PE or PI), a world price (PW), an

exchange rate (ER), and the appropriate transmission elasticities. MA is then calculated as a residual from equation (27).

Removal or liberalization of policies can be simulated by removing the subsidy equivalents from the observed base equilibrium situation. This will allow the calculation of domestic prices without the subsidy equivalents. If, in addition, the system of equations allows a recalculation of world prices to restore world trade equilibrium, then the adjustments will take into account all of the complex international feedbacks that will occur with policy changes. Three panel diagrams in figures 2, 3, and 4 illustrate the movements in prices and quantity between the protected (solid line ——) and liberalized (dashed line ----) situation if changes are made in particular subsidy equivalents. 2/

Figure 2--Removal of a Production Subsidy Equivalent in an Exporting Country



Results:

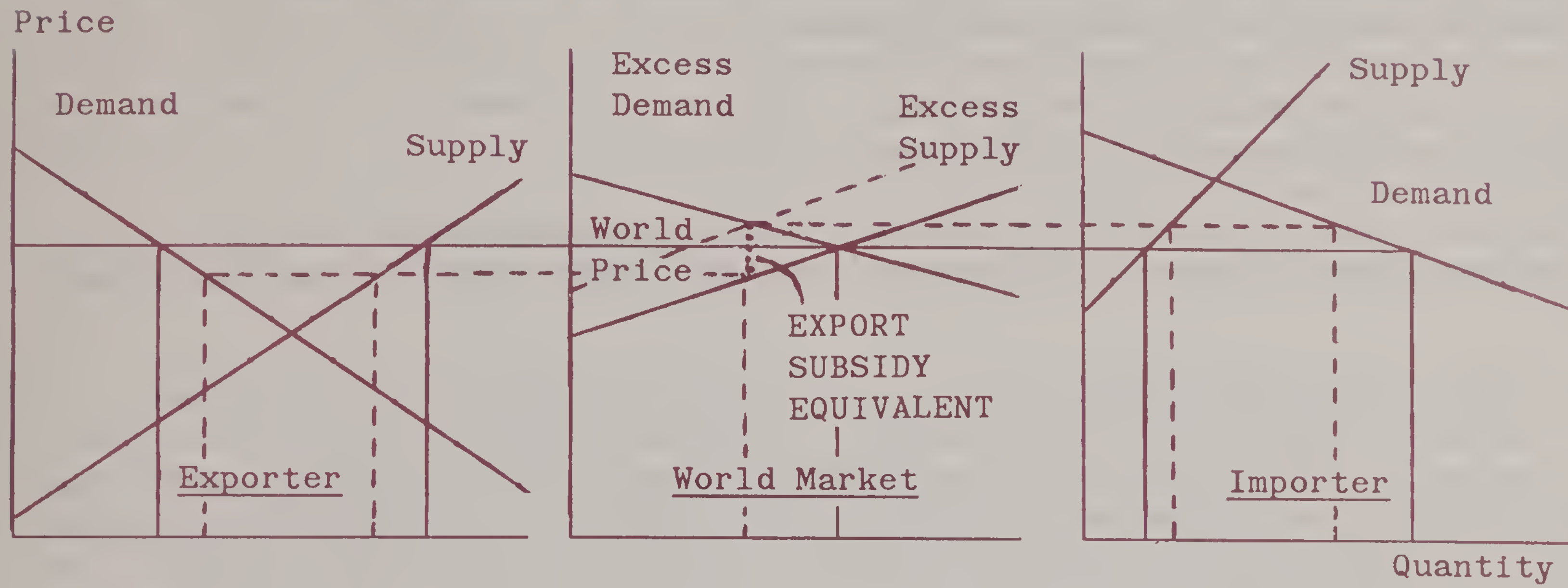
	Change		Change		Change
Production	↓	Trade	↓	Production	↑
Consumption	↓	World Price	↑	Consumption	↓
Exports	↓			Imports	↓
Producer Price*	↓			Producer Price	↑
Consumer Price	↑			Consumer Price	↑

* including the producer subsidy equivalent in the protected situation

In figure 2 the change in producer price in the exporting country is less than the amount of production subsidy equivalent removed. Part of the producer's loss in revenue from removal of the subsidy is offset by an increase in the world price that results when the subsidy equivalent is removed.

2/ For an analysis of the effect of policies on agriculture using three panel diagrams, see: Impacts of Policy on U.S. Agricultural Trade, Paarlberg, Webb, Morey and Sharples; Staff Report AGES840802, Econ. Res. Serv. U.S. Dept. Agr., Dec. 1984.

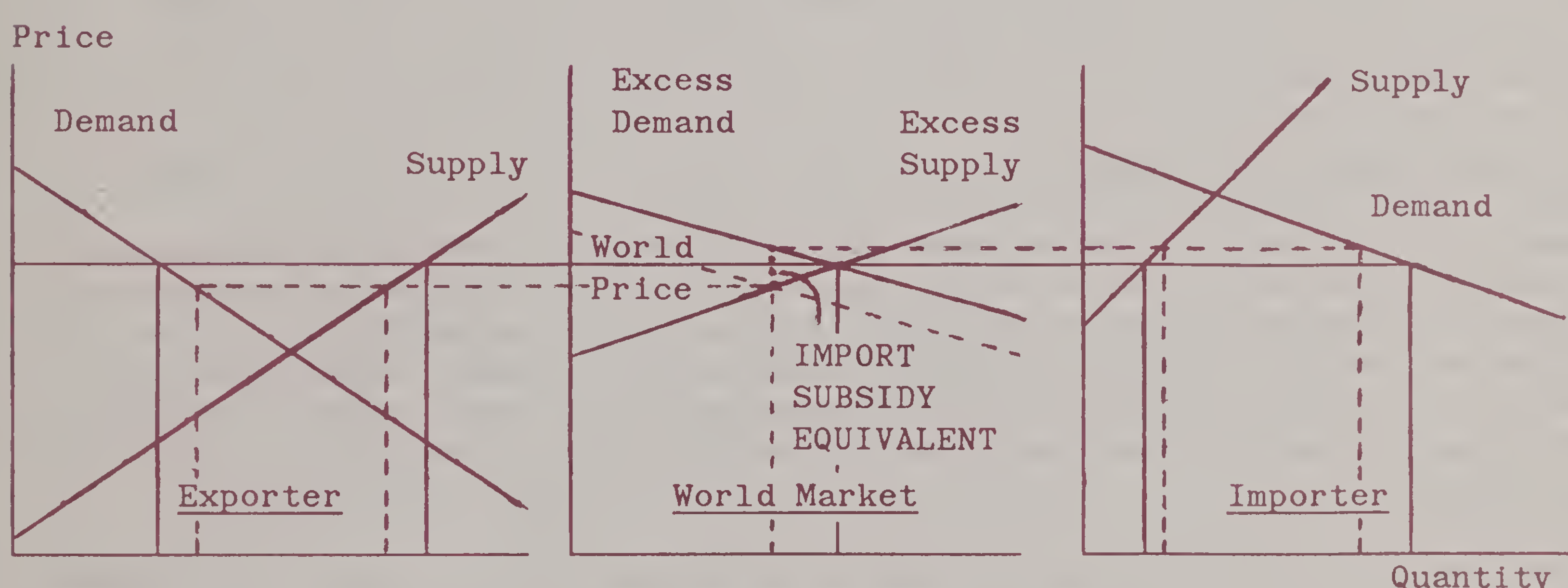
Figure 3--Removal of an Export Subsidy Equivalent in an Exporting Country



Results:

	Change		Change		Change
Production	↓	Trade	↓	Production	↑
Consumption	↑	World Price	↑	Consumption	↓
Exports	↓			Imports	↓
Producer Price	↓			Producer Price	↑
Consumer Price	↓			Consumer Price	↑

Figure 4--Removal of an Import Subsidy Equivalent in an Importing Country



Results:

	Change		Change		Change
Production	↓	Trade	↓	Production	↑
Consumption	↑	World Price	↓	Consumption	↓
Exports	↓			Imports	↓
Producer Price	↓			Producer Price	↑
Consumer Price	↓			Consumer Price	↑

All of the above price linkage equations are specified at the observed equilibrium situation which includes the effects of any policies in place. Liberalized equilibrium prices (prices which would operate if policy interventions were removed) are defined:

PPL Price (Production, Liberalized)
PCL Price (Consumption, Liberalized)

From the producer viewpoint, removal of the total production subsidy equivalent means that the producer now receives <u>less</u> per unit for the product or:

$$PPL = PP - (SP + SE - SI) \qquad (29)$$

The consumer, with the removal of subsidy equivalents, would now have to pay <u>more</u> per product consumed:

$$PCL = PC + (SC - SE + SI) \qquad (30)$$

Equations (29) and (30) give the initial arithmetic felt by the producer and consumer as subsidies are removed. But of course as they face new prices, they will adjust quantities and a full solution of a model, re-clearing world markets, is needed to find the final equilibrium prices and quantities resulting from removal of the subsidy equivalents.

Substituting equation (27) into equation (29) yields:

$$\underline{PPL = -SP - SE + SI + MA + CT * (ER \wedge TR) * (PW \wedge TW)} \qquad (31)$$

Substituting equations (29) and (30) into equation (28) yields:

$$PCL - SC + SE - SI = MD + PPL + SP + SE - SI \qquad (32)$$

which simplifies to :

$$\underline{PCL = MD + SC + SP + PPL} \qquad (33)$$

Equations (31) and (33) constitute the full price-policy linkage equations included in SWOPSIM models. When parameterized for an existing equilibrium situation, the insertion of subsidy equivalents will allow the recalculation of quantities and prices that <u>would</u> result if the subsidy equivalents were removed. In the models, the subsidy equivalents serve as shifters of quantity equations which, in turn, cause recalculation of equilibrium prices and quantities.

Equations (31) and (33) are the same as equations (27) and (28) except that they include subsidy equivalents which imply a different set of prices. The subsidy equivalents serve as shifters of supply and demand quantity equations toward their liberalized positions.

Market Clearing Mechanisms

The market clearing mechanisms are similar for single and multiple product models. World trade for a product is summed across countries/regions; the ratio of net world trade to world supply is calculated; then the world price of the product is raised if this ratio is negative (the world is a net importer) and is lowered if the ratio is positive. A damping factor allows the user to change the responsiveness of price adjustment if solution problems occur. The multi-product model includes this type of mechanism for each product so that a fully simultaneous solution is obtained with all markets cleared.

The models are solved simply by executing the spreadsheet in which they are constructed by the SWOPSIM procedures. The equations and market solution procedure are set up with "circular" references so that once the solution procedure is begun, it continues until values in the sheet change only by a small amount (the model has settled down and solved) or the iteration limit is reached (the model did not converge). This routine in the spreadsheet is, in effect, a Gauss-Seidel solution procedure for a set of simultaneous equations.

THE PROCEDURE FOR CREATING SWOPSIM MODELS

A set of computer procedures and programs allow the user to specify the world to be modeled and then create country/region spreadsheets using those specifications. Base quantity and price data are then added to the spreadsheets. The base trade data must be balanced on a world basis. Elasticities are then added to the spreadsheets and programs are run, using these elasticities and base data to add equations and constant terms to the spreadsheets. Once this task has been completed, procedures can be invoked to create world single and multi-product models from the country/region spreadsheets. These models are placed in their own spreadsheets and can be run independently. Figure 5 gives an overview of the various procedures and programs used to create SWOPSIM models. This is followed by a documented example of the use of these procedures to create a set of SWOPSIM models. The spreadsheets and their source BASIC computer programs are designed to use SuperCalc3, Release 2. 3/ However, after SuperCalc3 spreadsheets are created, they can be converted to other companies' spreadsheets by conversion programs.

The use of the SWOPSIM procedures is illustrated with the assembly of a small demonstration world agricultural trade model called DEMO. DEMO includes three countries: C1, C2, and RW (rest-of-world), and nine products--dairy farm milk (MK), butter and cheese (BC), fluid milk (FM), beef (BF), wheat (WH), corn (CN), soybeans (SB), soymeal (SM), and soyoil (SO). This product mix allows the full exercise of SWOPSIM capabilities, including derived demand and joint products.

3/ SORCIM/IUS Micro Software, SuperCalc3 (Release 2) - User's Guide and Reference Manual, Second ed., rev. 1984, San Jose, CA. For an example of a dynamic model operating in a SuperCalc3 spreadsheet environment, see: The World Grain, Oilseeds, and Livestock Model--A Microcomputer Version, by Roningen, Wainio, and Liu; Staff Report AGES850826, Econ. Res. Serv., U.S. Dept. Agr., Sept. 1985.

Figure 5--The Procedure for Creating SWOPSIM Models

Items	Comments
Master File - a spreadsheet. Used by all procedures.	Defines world to be modeled. Created by hand or cloned from another spreadsheet.
CREATE - a procedure. Run once to begin a new model. Invokes a basic program CSHEET.BAS which writes spreadsheet "xqt" files.	Creates country/region spreadsheets for products as defined in master file. Elasticities and base data must be entered into spreadsheets.
EQUATION - a procedure. Run whenever new elasticities or base data are entered and equations need to be updated. Invokes EQNA.BAS and EQNB.BAS.	Takes elasticities and base data entered into country/region spreadsheet and installs standard constant elasticity equations into the same spreadsheet. Constant terms (equation intercepts) are also recalculated.
Country/region spreadsheets.	Base data, elasticities, policies.
COMODMOD - a procedure. Run whenever changes in country/region spreadsheet data are significant enough to change equations in a product model. Can be run for as many products as are specified in master file. Invokes COMOD.BAS which writes "xqt" files to create models.	Takes product rows from country/region spreadsheets and assembles a world single product model in a new spreadsheet. Installs a world market clearing mechanism in the model.
World single product models - spreadsheets. One spreadsheet can be created for each product in master file.	Models solve (clear world market) with own price only. Cross prices assumed fixed.
WORLDMOD - a procedure. Run whenever country/region changes warrant assembling a new model. Invokes WORLD.BAS which writes "xqt" file which writes world model.	Create multi-product world SWOPSIM model with full world market clearing mechanism. Model is contained in a large spreadsheet.
Full world multi-product model - one large spreadsheet.	One fully simultaneous model which clears all world markets in response to policy changes.

Master Model File

The SWOPSIM model creation procedure requires a master model file. This spreadsheet file is a matrix where the country/region and product coverage of a model is set. The columns of the matrix define the countries/regions of the model while the rows define the product coverage.

Marking a "1" at the intersection of a row and column indicates that a supply-demand equation set will be created for that country/region and product. An "S" in a cell means that an equation will be created and that it will be possible to include this product demand variable in any supply equation. This allows joint product specification of equations. A "D" in a cell indicates that an equation will be created and that this product supply variable can be included in a demand equation. This allows the possibility for derived demand specification. A "SD" or "DS" marked in a cell allows both possibilities.

All country/region and product combinations do not have to have equations. This is indicated by a "." in a cell. This means that different products can have different regional coverage although the 'rest-of-world' residual region must be initialized with data so that the world is adequately modeled. The last column of the master matrix (not filled with . . .) must define a "rest-of-world" region which <u>must</u> include all products. This is needed to close the world model. Figure 6 shows the master matrix which defines the DEMO model. Note that WH and CN equations exist for all regions while equations for all other products exist only for C2 and RW. Base world prices must be given in column AR.

A "PRN" file of the master model file must be saved on the working disk. It is used as a reference file for all of the SWOPSIM procedures. Similarly, a "CAL" file must reside on the working disk along with all of the SWOPSIM BASIC and batch (BAT) programs. The inputs to the basic files are self prompting but the batch procedures should be given the four letter name of the master model file (in the example here--DEMO). Report writing, graphic display of output, and modification of standard models require the user to have a good working knowledge of spreadsheet techniques.

Figure 6--Master Model File for DEMO

```
     | A||B||C||D||E||F||G||H||I||J||K||L||M||N||O||P||Q||R||S||T||U||V||W||X||Y||Z|         |AQ||   AR  |
 1   DEMO   SWOPSIM    DEMOnstration Static WOrld Policy SImulation model           1
 2                                                                                   2
 3        C1 C2 RW - - - - - - - - - - - - - - - - - - - - - - -                   3         WDPRICE
 4                                                                                   4
 5     MK   . SD SD . . . . . . . . . . . . . . . . . . . . . . .                   5    MK    260.00
 6     BC   .  D  D . . . . . . . . . . . . . . . . . . . . . . .                   6    BC   2700.00
 7     FM   .  D  D . . . . . . . . . . . . . . . . . . . . . . .                   7    FM    300.00
 8     BF   .  D  D . . . . . . . . . . . . . . . . . . . . . . .                   8    BF   2500.00
 9     WH   1  1  1 . . . . . . . . . . . . . . . . . . . . . . .                   9    WH    200.00
10     CN   1  1  1 . . . . . . . . . . . . . . . . . . . . . . .                  10    CN    170.00
11     SB   .  S  S . . . . . . . . . . . . . . . . . . . . . . .                  11    SB    290.00
12     SM   .  1  1 . . . . . . . . . . . . . . . . . . . . . . .                  12    SM    250.00
13     SO   .  1  1 . . . . . . . . . . . . . . . . . . . . . . .                  13    SO    500.00
14      ^   . . . . . . . . . . . . . . . . . . . . . . . . . .                    14    ^
```

Figure 6--concluded

```
   | A||B||C||D||E||F||G||H||I||J||K||L||M||N||O||P||Q||R||S||T||U||V||W||X||Y||Z|
58  DEFINITION OF MATRIX CELL CODES
59
60     .   No equation created for this country/region and product
61         (however, note that RW region MUST have equations for all
62         commodities to close world model).
63
64     1   Supply and demand equations created for this country/region
65         and product.
66
67     S   Supply and demand equations created AND demand quantity for this
68         country/region and product can be included in any SUPPLY equation.
69
70     D   Supply and demand equations created AND supply quantity for this
71         country/region and product can be included in any DEMAND equation.
72
73    SD   Supply and demand equations created AND demand quantity for this
74    or   country/region and product can be included in any SUPPLY equation
75    DS   AND supply quantity for this country/region and product can be
76         included in any DEMAND equation.
77
78
79   CODE  PRODUCT GROUP ---------------------------------------
80
81    MK   total MilK (not traded - used to make BC and FM below)
82    BC   Butter and Cheese
83    FM   Fluid Milk (not traded)
84    BF   Beef and Veal
85    WH   WHeat
86    CN   CorN
87    SB   SoyBeans
88    SM   SoyMeal
89    SO   SoyOil
90
91     ^   other possible products
92
93
94   CODE   COUNTRY/REGION ----------------
95
96    C1   Country 1
97    C2   Country 2
98    RW   Rest-of-World
99
100    -   other possible countries/regions
```

Creation of Country/Region Spreadsheets

A procedure (CREATE) is run, having been given the four letter name of the master file, to create individual country/region spreadsheets as specified in that file. Base data and elasticities are then entered manually into these spreadsheets in order to initialize and parameterize each country/region model.

The CREATE procedure is simply an IBM DOS batch file which erases any existing files under the same master file name (save old ones if they are to be preserved). It calls a basic program (CSHEET.BAS) which, in turn creates SuperCalc3 ".XQT" files which are run from a batch program (also created) called LOAD. This sequence results in the creation of "blank" spreadsheets with zeros for base data and elasticities for each country/region specified in the master file.

A country/region spreadsheet contains a matrix for supply and demand elasticities and a series of rows for each product, into which base quantity and price data can be entered. Explanations of the column headings for the rows containing the base data and the equations are given in figure 7.

Figure 7--Explanations of Column Headings for Product Rows in Country/Region Spreadsheet (DEMO-RW used as example)

Column Head	Explanation (* - items to be entered in spreadsheet)
DEMO-RW	Name of (RW) region spreadsheet derived from (DEMO) master file
WDPRICE	Base world price from (DEMO) master file
PRPRICE	Base producer price *
CNPRICE	Base consumer price *
TDPRICE	Base trade price (export or import) *
XRATE	Base exchange rate (domestic currency per U.S. $) *
SUPPLY	Base supply quantity *
DEMAND	Base demand quantity *
NTRADE	Base net trade quantity *
XRATE EL	Exchange rate transmission elasticity * (enter at top)
WDPT. EL	Domestic-world price transmission elasticity * (dflt.=1)
SSHIFT	Supply shift variable * (no shift=0, 10% increase=.1)
DSHIFT	Demand shift variable * (")
PRSUBEQ	Producer subsidy equivalent * (add only in model sheets)
CNSUBEQ	Consumer subsidy equivalent * (")
IMSUBEQ	Import subsidy equivalent * (")
EXSUBEQ	Export subsidy equivalent * (")
IMQUOTA	Import quota * (mechanics to handle must be added)
EXQUOTA	Export quota * (")
TDCONST	Trade price equation constant [CT in equation (27)]
PRCONST	Producer price equation constant [MA in equation (27)]
CNCONST	Consumer price equation constant [MD in equation (28)]
LPRPRICE	Liberalized producer price [equation (31)]
LCNPRICE	Liberalized consumer price [equation (11)]
SCROSS	Supply equation cross price terms (written by EQUATION)
DCROSS	Demand equation cross price terms (written by EQUATION)
SCONST	Supply equation constant (written by EQUATION)
DCONST	Demand equation constant (written by EQUATION)
SUPPLYEQ	Supply equation (using SCONST and SCROSS - written by EQUATION procedure)
DEMANDEQ	Demand equation (using DCONST and DCROSS - written by EQUATION procedure)
NTRADEEQ	Net trade equation (written by EQUATION procedure)
SUPPLYD	Supply difference (between equation and base quantity)
DEMANDD	Demand difference (")

Figure 7--concluded

NTRADED	Net trade difference (")
PRPRICED	Producer price difference (between eq. and base value)
CNPRICED	Consumer price difference (")
TDPRICED	Trade price difference (between equation and base value)
SUPPLY%	Percentage change in supply quantity from base
PRPRICE%	Percentage change in producer price from base
DEMAND%	Percentage change in demand quantity from base
CNPRICE%	Percentage change in consumer price from base
NTRADE%	Percentage change in net trade quantity from base
*	Columns AQ through AZ are available for individual spreadsheet modifications (e.g. quotas, non-traded products, etc.). These columns are carried along from the country/region spreadsheets into the model spreadsheets by SWOPSIM procedures.

Figure 8 shows the spreadsheet created from the DEMO master matrix for the region RW. The sheet would, upon creation, have zeros in the elasticity matrices but elasticities and base data have been entered by hand into the sheet for use by other SWOPSIM procedures. In addition, equations have been added. Own and cross price elasticities are given in the supply (SUPPLY EL) and demand (DEMAND EL) elasticity matrices. The column headings of these matrices marked with product codes preceded by "D" and "S", respectively, allow the insertion of a constant elasticity which will be used for the marked product in the demand and supply equations. For example, an elasticity of 1 in the supply elasticity row for BC below DMK means that the MK demand variable will be included in the BC supply equation with a constant elasticity of 1. Similarly, a .6 under SBF in the CN row of the demand matrix means that the beef supply variable will be included in the corn demand equation with a constant elasticity of .6 (which should be the historical share of total CN demand going to feed BF. The world prices from the master DEMO file have been put in column B (starting in row 27). The column headings for the product rows (row 26) are explained in figure 7 above.

Immediately after the country sheets are created, zeros will appear in the cells requiring data (e.g. C27 in DEMO-RW - producer price for MK). Other cells such as AC27 in DEMO-RW will be blank and will be filled by the EQUATION procedure. If an elasticity is to be omitted from a model, this is accomplished by simply leaving a .00 in the cell of the elasticity matrices (or a space under the designation of demand and supply quantity variables for equations).

Finally, column AQ shows some content for MK and FM. Recall that this column (through AZ) can be used to customize equations in countries. In this case, an equation (to be described later) is inserted to prevent MK and FM from being traded at all. The product rows from column A through column AZ are carried along into all model spreadsheets created by SWOPSIM procedures. The extra cells can be used to modify particular equations, create welfare calculations, store protection information, etc.

Figure 8--Sample Spreadsheet for DEMO-RW

	A	B	C	D	E	F	G	H	I	J	K
1	DEMO-RW		XRATE (LC/US$) =		1			XRATE ELASTICITY =		1	
2											
3	SUPPLY EL	MK	BC	FM	BF	WH	CN	SB	SM	SO	DMK
4	MK	.50	.00	.00	-.20	.00	-.10	.00	.00	.00	
5	BC	.00	.30	-.10	.00	.00	.00	.00	.00	.00	1
6	FM	.00	.00	.00	.00	.00	.00	.00	.00	.00	1
7	BF	.05	.00	.00	.60	-.05	-.10	.00	.00	.00	
8	WH	.00	.00	.00	.00	.50	-.10	-.10	.00	.00	
9	CN	.00	.00	.00	.00	-.10	.40	-.20	.00	.00	
10	SB	.00	.00	.00	.00	-.05	-.10	.45	.00	.00	
11	SM	.00	.00	.00	.00	.00	.00	.00	.00	.00	
12	SO	.00	.00	.00	.00	.00	.00	.00	.00	.00	
13											
14	DEMAND EL	MK	BC	FM	BF	WH	CN	SB	SM	SO	SMK
15	MK	-.13	.00	.00	.00	.00	.00	.00	.00	.00	
16	BC	.00	-.50	.00	.00	.00	.00	.00	.00	.00	
17	FM	.00	.00	-.30	.00	.00	.00	.00	.00	.00	
18	BF	.00	.00	.00	-.80	.00	.00	.00	.00	.00	
19	WH	.00	.00	.00	.00	-.35	.20	.00	.00	.00	.1
20	CN	.00	.00	.00	.00	.05	-.60	.00	.15	.00	.2
21	SB	.00	.00	.00	.00	.00	.00	-.53	.77	.14	
22	SM	.00	.00	.00	.00	.10	.70	.00	-1.00	.00	.3
23	SO	.00	.00	.00	.00	.00	.00	.00	.00	-.50	
24											
25											
26	DEMO-RW	WDPRICE	PRPRICE	CNPRICE	TDPRICE	XRATE	SUPPLY	DEMAND	NTRADE	XRATE EL	WDPT.EL
27	MK	260	260	260	260	1	65000	65000	0	1	1
28	BC	2700	2700	2900	2700	1	4000	3800	200	1	1
29	FM	300	300	500	300	1	20000	20000	0	1	1
30	BF	2500	2500	5000	2500	1	11000	10000	1000	1	1
31	WH	200	200	220	200	1	90000	125000	-35000	1	1
32	CN	170	170	200	170	1	220000	320000	-100000	1	1
33	SB	290	290	300	290	1	5000	35000	-30000	1	1
34	SM	250	250	250	250	1	27000	31000	-4000	1	1
35	SO	500	500	500	500	1	5000	7000	-2000	1	1

	L	M	N	O	P	Q	R	S	T	U	V
1											
2											
3	DSB						ROWSUM				
4							.2				
5							.2				
6							0				
7							.5				
8							.3				
9							.1				
10							.3				
11	1						0				
12	1						0				
13											

Figure 8--concluded

	SBC	SFM	SBF	ROWSUM	S-D
14	SBC	SFM	SBF	ROWSUM	S-D
15	.06	.31		-.127811	.3278107
16				-.5	.7
17				-.3	.3
18				-.8	1.3
19			.2	-.15	.45
20			.6	-.4	.5
21				.3843537	-.084354
22			.5	-.2	.2
23				-.5	.5
24					
25					

26	SSHIFT	DSHIFT	PRSUBEQ	CNSUBEQ	IMSUBEQ	EXSUBEQ	IMQUOTA	EXQUOTA	TDCONST	PRCONST	CNCONST
27	.00	.00							1	0	0
28	.00	.00							1	0	200
29	.00	.00							1	0	200
30	.00	.00							1	0	2500
31	.00	.00							1	0	20
32	.00	.00							1	0	30
33	.00	.00							1	0	10
34	.00	.00							1	0	0
35	.00	.00							1	0	0

| | W || X || Y || Z || AA || AB || AC || AD || AE || AF || AG |

1

26	LPRPRICE	LCNPRICE	SCROSS	DCROSS	SCONST	DCONST	SUPPLYEQ	DEMANDEQ	NTRADEEQ	SUPPLYD	DEMANDD
27	260	260	.1251316	35.43585	32215.11	3779.349	65000	65000	1.46e-11	0	0
28	2700	2900	36745.25	1	.0101730	204636.3	4000	3800	200	0	0
29	300	500	65000	1	.3076923	129039.0	20000	20000	0	0	0
30	2500	5000	.6062507	1	165.9497	9102821.	11000	10000	1000	0	0
31	200	220	.3394027	56.20512	18750.47	14688.66	90000	125000	-35000	0	0
32	170	200	.1894163	7315.271	148876.3	1050.842	220000	320000	-100000	0	0
33	290	300	.4590961	167.5983	849.1556	4292.128	5000	35000	-30000	0	0
34	250	250	35000	203954.7	.7714286	37.99864	27000	31000	-4000	0	0
35	500	500	35000	1	.1428571	156524.8	5000	7000	-2000	0	0

| AH || AI || AJ || AK || AL || AM || AN || AO || AP || AQ |

1

26	NTRADED	PRPRICED	CNPRICED	TDPRICE%	SUPPLY%	PRPRICE%	DEMAND%	CNPRICE%	NTRADE%	MKADJ
27	0	0	0	.00	.00	.00	.00	.00	ERROR	0
28	0	0	0	.00	.00	.00	.00	.00	.00	
29	0	0	0	.00	.00	.00	.00	.00	ERROR	0
30	0	0	0	.00	.00	.00	.00	.00	.00	
31	0	0	0	.00	.00	.00	.00	.00	.00	
32	0	0	0	.00	.00	.00	.00	.00	.00	
33	0	0	0	.00	.00	.00	.00	.00	.00	
34	0	0	0	.00	.00	.00	.00	.00	.00	
35	0	0	0	.00	.00	.00	.00	.00	.00	

Addition of Equations to Country/Region Spreadsheets

A batch procedure (EQUATION) invokes two basic programs (EQNA and EQNB) which take the elasticities entered into the country spreadsheet and writes standard equations in the appropriate columns of the spreadsheet. The term EQUATION should be typed in followed by the four letter name of the master model file to be used. The programs also calculate the constants (intercepts) for the equations from the base data. Note that the equations themselves are broken up into parts in the spreadsheet. Cross price terms of the equations are contained in a separate cell from the own price portion. The equations do not contain references to cells containing elasticities; rather, they contain the elasticities themselves. This allows the equations to be copied by other programs into world model files. This means that if elasticities (or base data) are changed, equations and constants must be recreated via the EQUATION procedure.

Listings of these three programs are provided in Appendix A. Figure 9 shows the actual equations and constants inserted by the procedures into the model file DEMO-RW. Figure 9 also shows the liberalized price formulas which are created by the CREATE procedure (columns W and X). These standard formulas have features including logical switches to prevent, for example, the continued removal of an export subsidy if the country has become an importer in the course of solution. Also, prices are prevented from becoming negative and thus causing solution problems. The liberalized prices produced in these cells are the ones referenced in the supply and demand equations.

Figure 9--Equations for DEMO-RW

```
    |  V  ||                                  W                                      |
26   DEMO-RW                               LPRPRICE
27        MK MAX(T27-M27+IF(AE27<0,O27,0)-IF(AE27>=0,P27,0)+S27*(E27^I27)*(A27^J27),1)+.5*AQ27
28        BC MAX(T28-M28+IF(AE28<0,O28,0)-IF(AE28>=0,P28,0)+S28*(E28^I28)*(A28^J28),1)
29        FM MAX(T29-M29+IF(AE29<0,O29,0)-IF(AE29>=0,P29,0)+S29*(E29^I29)*(A29^J29),1)+.5*AQ29
30        BF MAX(T30-M30+IF(AE30<0,O30,0)-IF(AE30>=0,P30,0)+S30*(E30^I30)*(A30^J30),1)
31        WH MAX(T31-M31+IF(AE31<0,O31,0)-IF(AE31>=0,P31,0)+S31*(E31^I31)*(A31^J31),1)
32        CN MAX(T32-M32+IF(AE32<0,O32,0)-IF(AE32>=0,P32,0)+S32*(E32^I32)*(A32^J32),1)
33        SB MAX(T33-M33+IF(AE33<0,O33,0)-IF(AE33>=0,P33,0)+S33*(E33^I33)*(A33^J33),1)
34        SM MAX(T34-M34+IF(AE34<0,O34,0)-IF(AE34>=0,P34,0)+S34*(E34^I34)*(A34^J34),1)
35        SO MAX(T35-M35+IF(AE35<0,O35,0)-IF(AE35>=0,P35,0)+S35*(E35^I35)*(A35^J35),1)

    |          X          ||             Y              ||                 Z                      |
26         LCNPRICE                   SCROSS                             DCROSS
27   MAX(W27+M27+N27+U27,1)  1*(W30^-.2)*(W32^-.1)           1*(AC28^.06)*(AC29^.31)
28   MAX(W28+M28+N28+U28,1)  1*(W29^-.1)*(AD27^1)            1
29   MAX(W29+M29+N29+U29,1)  1*(AD27^1)                      1
30   MAX(W30+M30+N30+U30,1)  1*(W27^.05)*(W31^-.05)*(W32^-.1) 1
31   MAX(W31+M31+N31+U31,1)  1*(W32^-.1)*(W33^-.1)           1*(X32^.2)*(AC27^.1)*(AC30^.2)
32   MAX(W32+M32+N32+U32,1)  1*(W31^-.1)*(W33^-.2)           1*(X31^.05)*(X34^.15)*(AC27^.2)*(AC30^.6)
33   MAX(W33+M33+N33+U33,1)  1*(W31^-.05)*(W32^-.1)          1*(X34^.77)*(X35^.14)
34   MAX(W34+M34+N34+U34,1)  1*(AD33^1)                      1*(X31^.1)*(X32^.7)*(AC27^.3)*(AC30^.5)
35   MAX(W35+M35+N35+U35,1)  1*(AD33^1)                      1
```

Figure 9--concluded

	AA	AB	AC	AD	AE
26	SCONST	DCONST	SUPPLYEQ	DEMANDEQ	NTRADEEQ
27	32215.10	3779.348	(1+K27)*AA27*Y27*W27^.5	(1+L27)*AB27*Z27*X27^-.13	AC27-AD27
28	.0101730	204636.2	(1+K28)*AA28*Y28*W28^.3	(1+L28)*AB28*Z28*X28^-.5	AC28-AD28
29	.3076923	129039.0	(1+K29)*AA29*Y29*W29^0	(1+L29)*AB29*Z29*X29^-.3	AC29-AD29
30	165.9496	9102821.	(1+K30)*AA30*Y30*W30^.6	(1+L30)*AB30*Z30*X30^-.8	AC30-AD30
31	18750.47	14688.65	(1+K31)*AA31*Y31*W31^.5	(1+L31)*AB31*Z31*X31^-.35	AC31-AD31
32	148876.3	1050.842	(1+K32)*AA32*Y32*W32^.4	(1+L32)*AB32*Z32*X32^-.6	AC32-AD32
33	849.1556	4292.128	(1+K33)*AA33*Y33*W33^.45	(1+L33)*AB33*Z33*X33^-.53	AC33-AD33
34	.7714285	37.99864	(1+K34)*AA34*Y34*W34^0	(1+L34)*AB34*Z34*X34^-1	AC34-AD34
35	.1428571	156524.7	(1+K35)*AA35*Y35*W35^0	(1+L35)*AB35*Z35*X35^-.5	AC35-AD35

Creation of World Single Product Models

A procedure (COMODMOD) invokes a basic program (COMOD) which reads the master file and the individual country/region spreadsheet files and creates a world single product model spreadsheet for the selected product. The world product model adds world trade market clearing conditions and a world solution price mechanism to country/region equations. The model will clear the world trade market for the product simply by recalculating the spreadsheet. This is done mechanically in a GAUSS-SEIDEL fashion by the spreadsheet's ability to handle circular cell references. Insertion of policy variable values and recalculation of the sheet gives estimates of changes in various quantities and prices from base values. The product model spreadsheet also includes several "indicator" variables. More indicators and graphs can be added as templates by the user once a particular model has been created.

Figure 10 shows a spreadsheet model for DEMO^WH created with the COMODMOD procedure. The WH product model consists of a row containing data, parameters, and equations for each region plus an extra row containing the world market clearing mechanism. The column headings are the same ones appearing in the country/region spreadsheets and explained in figure 7. Note that in the world single product models, quantities are functions of "own" prices only, since cross prices do not change in the "single" product model. These models are useful in themselves for "quick" policy analysis and as an intermediate step in preparing a "solvable" world multi-region multi-product model.

Figure 10--DEMO^WH Single Product World Model

	A	B	C	D	E	F	G	H	I	J	K
1	DEMO^WH	WDPRICE	PRPRICE	CNPRICE	TDPRICE	XRATE	SUPPLY	DEMAND	NTRADE	XRATE EL	WDPT.EL
2	DEMO-C1	200	200	200	200	1	5000	9000	-4000	1	1
3	DEMO-C2	200	200	220	200	1	66000	27000	39000	1	1
4	DEMO-RW	200	200	220	200	1	90000	125000	-35000	1	1
5											
6							161001		78000	0	0

Figure 10--concluded

	L	M	N	O	P	Q	R	S	T	U	V
1	SSHIFT	DSHIFT	PRSUBEQ	CNSUBEQ	IMSUBEQ	EXSUBEQ	IMQUOTA	EXQUOTA	TDCONST	PRCONST	CNCONST
2	.00	.00							1	0	0
3	.00	.00							1	0	20
4	.00	.00							1	0	20
5											
6	0	ABWDTRD	39000		78000	0	0	0	ABWDTEQ	39000	

	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
1	LPRPRICE	LCNPRICE	SCROSS	DCROSS	SCONST	DCONST	SUPPLYEQ	DEMANDEQ	NTRADEEQ	SUPPLYD	DEMANDD
2	200	200	.5887040	1	600.5622	127279.2	5000	9000	-4000	0	0
3	200	220	.3394027	54.51912	13750.35	1907.307	66000	27000	39000	0	0
4	200	220	.3394027	56.20512	18750.47	14688.66	90000	125000	-35000	0	0
5											
6	WDTRADE%	.00	WDPRICE%	.00	WDPRICE	200	LWDPRICE	200	-2.0e-10		DAMP.WT

	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
1	NTRADED	PRPRICED	CNPRICED	TDPRICE%	SUPPLY%	PRPRICE%	DEMAND%	CNPRICE%	NTRADE%	MKADJ
2	0	0	0	.00	.00	.00	.00	.00	.00	
3	0	0	0	.00	.00	.00	.00	.00	.00	
4	0	0	0	.00	.00	.00	.00	.00	.00	
5										
6	1	200	SUPDEM%	.00						

The world single product (as well as the full multi-product) models have a "damping" parameter in the solution row. This is set at one by default. But, if oscillatory solution problems occur, this parameter can be set to smaller values in order to allow smaller changes in prices in each iteration. Figure 10 also shows, in the rightmost columns, some extra variables which are derived indicators. These variables (SUPPLY%, etc.) were also copied from the country/region spreadsheets by the COMODMOD procedure. They serve as quick indicators of results of a policy change simulation. A user could add more indicators in the form of a "template" spreadsheet which can be added to any product model. This technique allows the user to add equations, graphs, indicators, anything "doable" in spreadsheets to basic model spreadsheets once they have been defined and created and adds greatly to the flexibility and convenience of modeling in the micro computer spreadsheet.

Creation of a World Multi-Product Model

The final procedure (WORLDMOD) creates a full simultaneous multi-region multi-product model from country/region spreadsheets. In this model, all cross price terms are active in model equations and the full implications of any policy change can be calculated out with total world product-region adjustment. Figure 11 shows DEMO-WD, the sample world model created from the master file DEMO and the three country/region spreadsheets.

The layout of the full world model stacks the country/region product rows below one another and follows them with a set of world market clearing conditions and equations for each product (rows 44-52 in figure 11). Totals for world trade (the absolute value summed and divided by two) are calculated.

Figure 11--DEMO-WD World Model

	A	B	C	D	E	F	G	H	I	J	K
1	DEMO-C1		XRATE (LC/US$) =		1			XRATE ELASTICITY =		1	
2											
3	DEMO-C1	WDPRICE	PRPRICE	CNPRICE	TDPRICE	XRATE	SUPPLY	DEMAND	NTRADE	XRATE EL	WDPT.EL
4		260.00									
5		2700.00									
6		300.00									
7		2500.00									
8	WH	200.00	200	200	200	1	5000	9000	-4000	1	1
9	CN	170.00	200	200	200	1	30000	10000	20000	1	1
10		290.00									
11		250.00									
12		500.00									
15	DEMO-C2		XRATE (LC/US$) =		1			XRATE ELASTICITY =		1	
16											
17	DEMO-C2	WDPRICE	PRPRICE	CNPRICE	TDPRICE	XRATE	SUPPLY	DEMAND	NTRADE	XRATE EL	WDPT.EL
18	MK	260.00	260	260	260	1	58000	58000	0	1	1
19	BC	2700.00	2700	2900	2700	1	2300	2500	-200	1	1
20	FM	300.00	300	500	300	1	30000	30000	0	1	1
21	BF	2500.00	2500	5000	2500	1	10000	11000	-1000	1	1
22	WH	200.00	200	220	200	1	66000	27000	39000	1	1
23	CN	170.00	170	200	170	1	250000	170000	80000	1	1
24	SB	290.00	290	300	290	1	55000	25000	30000	1	1
25	SM	250.00	250	250	250	1	19500	15500	4000	1	1
26	SO	500.00	500	500	500	1	4000	2000	2000	1	1
29	DEMO-RW		XRATE (LC/US$) =		1			XRATE ELASTICITY =		1	
30											
31	DEMO-RW	WDPRICE	PRPRICE	CNPRICE	TDPRICE	XRATE	SUPPLY	DEMAND	NTRADE	XRATE EL	WDPT.EL
32	MK	260.00	260	260	260	1	65000	65000	0	1	1
33	BC	2700.00	2700	2900	2700	1	4000	3800	200	1	1
34	FM	300.00	300	500	300	1	20000	20000	0	1	1
35	BF	2500.00	2500	5000	2500	1	11000	10000	1000	1	1
36	WH	200.00	200	220	200	1	90000	125000	-35000	1	1
37	CN	170.00	170	200	170	1	220000	320000	-100000	1	1
38	SB	290.00	290	300	290	1	5000	35000	-30000	1	1
39	SM	250.00	250	250	250	1	27000	31000	-4000	1	1
40	SO	500.00	500	500	500	1	5000	7000	-2000	1	1
43	DEMO-WD	WDPRICE			SUPDWD1	SUPDWD2	SUPDEMWD		ABWDTRD1	ABWDTRD2	ABWDTRD3
44	MK	260			123000	0	123000		0	0	0
45	BC	2700			6300	0	6300		400	0	0
46	FM	300			50000	0	50000		0	0	0
47	BF	2500			21000	0	21000		2000	0	0
48	WH	200			161000	0	161000		78000	0	0
49	CN	170			500000	0	500000		200000	0	0
50	SB	290			60000	0	60000		60000	0	0
51	SM	250			46500	0	46500		8000	0	0
52	SO	500			9000	0	9000		4000	0	0

Figure 11--continued

	L	M	N	O	P	Q	R	S	T	U	V
3	SSHIFT	DSHIFT	PRSUBEQ	CNSUBEQ	IMSUBEQ	EXSUBEQ	IMQUOTA	EXQUOTA	TDCONST	PRCONST	CNCONST
8	.00	.00							1	0	0
9	.00	.00							1.176471	0	0
17	SSHIFT	DSHIFT	PRSUBEQ	CNSUBEQ	IMSUBEQ	EXSUBEQ	IMQUOTA	EXQUOTA	TDCONST	PRCONST	CNCONST
18	.00	.00							1	0	0
19	.00	.00							1	0	200
20	.00	.00							1	0	200
21	.00	.00							1	0	2500
22	.00	.00							1	0	20
23	.00	.00							1	0	30
24	.00	.00							1	0	10
25	.00	.00							1	0	0
26	.00	.00							1	0	0
31	SSHIFT	DSHIFT	PRSUBEQ	CNSUBEQ	IMSUBEQ	EXSUBEQ	IMQUOTA	EXQUOTA	TDCONST	PRCONST	CNCONST
32	.00	.00							1	0	0
33	.00	.00							1	0	200
34	.00	.00							1	0	200
35	.00	.00							1	0	2500
36	.00	.00							1	0	20
37	.00	.00							1	0	30
38	.00	.00							1	0	10
39	.00	.00							1	0	0
40	.00	.00							1	0	0
43	ABWDTRD4		ABWDTRD						SUPDEQ1	SUPDEQ2	WDTRD1
44	0		0						123000	0	0
45	0		200						6300	0	1.32e-11
46	0		0						50000	0	1.09e-11
47	0		1000						21000	0	5.28e-11
48	0		39000						161000	0	-3.2e-10
49	0		100000						500000	0	-1.66e-9
50	0		30000						60000	0	-4.7e-11
51	0		4000						46500	0	-2.2e-11
52	0		2000						9000	0	2.34e-11

	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG
3	LPRPRICE	LCNPRICE	SCROSS	DCROSS	SCONST	DCONST	SUPPLYEQ	DEMANDEQ	NTRADEEQ	SUPPLYD	DEMANDD
8	200	200	.5887040	1	600.5622	127279.2	5000	9000	-4000	0	0
9	200	200	.5887040	1	3603.373	141421.4	30000	10000	20000	0	0

Note that the printout of this spreadsheet omits blank rows to save space.

Figure 11--continued

17	LPRPRICE	LCNPRICE	SCROSS	DCROSS	SCONST	DCONST	SUPPLYEQ	DEMANDEQ	NTRADEEQ	SUPPLYD	DEMANDD
18	260	260	.1617669	290.1163	22235.75	249.7208	58000	58000	-8.7e-11	0	0
19	2700	2900	18535.48	1	.0115962	134629.1	2300	2500	-200	0	0
20	300	500	58000	1	.5172414	193558.5	30000	30000	-2.2e-11	0	0
21	2500	5000	.6062507	1	150.8633	1822950.	10000	11000	-1000	0	0
22	200	220	.3394027	54.51912	13750.35	1907.307	66000	27000	39000	0	0
23	170	200	.1894163	6753.015	169177.7	604.7407	250000	170000	80000	0	0
24	290	300	.4590961	200.5527	9340.712	2871.629	55000	25000	30000	0	0
25	250	250	25000	472054.0	.78	8.208807	19500	15500	4000	0	0
26	500	500	25000	1	.16	44721.36	4000	2000	2000	0	0

31	LPRPRICE	LCNPRICE	SCROSS	DCROSS	SCONST	DCONST	SUPPLYEQ	DEMANDEQ	NTRADEEQ	SUPPLYD	DEMANDD
32	260	260	.1251316	35.43585	32215.11	3779.349	65000	65000	8.73e-11	0	0
33	2700	2900	36745.25	1	.0101730	204636.3	4000	3800	200	0	0
34	300	500	65000	1	.3076923	129039.0	20000	20000	3.27e-11	0	0
35	2500	5000	.6062507	1	165.9497	9102821.	11000	10000	1000	0	0
36	200	220	.3394027	56.20512	18750.47	14688.66	90000	125000	-35000	0	0
37	170	200	.1894163	7315.271	148876.3	1050.842	220000	320000	-100000	0	0
38	290	300	.4590961	167.5983	849.1556	4292.128	5000	35000	-30000	0	0
39	250	250	35000	203954.7	.7714286	37.99864	27000	31000	-4000	0	0
40	500	500	35000	1	.1428571	156524.8	5000	7000	-2000	0	0

43	WDTRD2	ABSWDTD1	ABSWDTD2	ABSWDTD3	ABSWDTD4	DEMO-WD	SUPDEMEQ	WDPRICE	WDTRADE	ABSWDTRD	WEIGHT
44	0	1.75e-10	0	0	0	MK	123000	260.00	0	8.73e-11	1
45	0	400	0	0	0	BC	6300	2700.00	1.32e-11	200	1
46	0	5.46e-11	0	0	0	FM	50000	300.00	1.09e-11	2.73e-11	1
47	0	2000	0	0	0	BF	21000	2500.00	5.28e-11	1000	1
48	0	78000	0	0	0	WH	161000	200.00	-3.2e-10	39000	1
49	0	200000	0	0	0	CN	500000	170.00	-1.66e-9	100000	1
50	0	60000	0	0	0	SB	60000	290.00	-4.7e-11	30000	1
51	0	8000	0	0	0	SM	46500	250.00	-2.2e-11	4000	1
52	0	4000	0	0	0	SO	9000	500.00	2.34e-11	2000	1

	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ

3	NTRADED	PRPRICED	CNPRICED	TDPRICE%	SUPPLY%	PRPRICE%	DEMAND%	CNPRICE%	NTRADE%
8	0	0	0	.00	.00	.00	.00	.00	.00
9	0	-7.1e-13	-7.1e-13	.00	.00	.00	.00	.00	.00

17	NTRADED	PRPRICED	CNPRICED	TDPRICE%	SUPPLY%	PRPRICE%	DEMAND%	CNPRICE%	NTRADE%	MKADJ
18	0	0	0	.00	.00	.00	.00	.00	ERROR	0
19	0	0	0	.00	.00	.00	.00	.00	.00	
20	0	0	0	.00	.00	.00	.00	.00	ERROR	0
21	0	0	0	.00	.00	.00	.00	.00	.00	
22	0	0	0	.00	.00	.00	.00	.00	.00	
23	0	0	0	.00	.00	.00	.00	.00	.00	
24	0	0	0	.00	.00	.00	.00	.00	.00	
25	0	0	0	.00	.00	.00	.00	.00	.00	
26	0	0	0	.00	.00	.00	.00	.00	.00	

Figure 11--concluded

31	NTRADED	PRPRICED	CNPRICED	TDPRICE%	SUPPLY%	PRPRICE%	DEMAND%	CNPRICE%	NTRADE%	MKADJ
32	0	0	0	.00	.00	.00	.00	.00	ERROR	0
33	0	0	0	.00	.00	.00	.00	.00	.00	
34	0	0	0	.00	.00	.00	.00	.00	ERROR	0
35	0	0	0	.00	.00	.00	.00	.00	.00	
36	0	0	0	.00	.00	.00	.00	.00	.00	
37	0	0	0	.00	.00	.00	.00	.00	.00	
38	0	0	0	.00	.00	.00	.00	.00	.00	
39	0	0	0	.00	.00	.00	.00	.00	.00	
40	0	0	0	.00	.00	.00	.00	.00	.00	

43	LWDPRICE	SUPDEM%	WDPRICED	WDPRICE%	WDTRADE%
44	260.00	.00	.00	.00	ERROR
45	2700.00	.00	.00	.00	.00
46	300.00	.00	.00	.00	ERROR
47	2500.00	.00	.00	.00	.00
48	200.00	.00	.00	.00	.00
49	170.00	.00	.00	.00	.00
50	290.00	.00	.00	.00	.00
51	250.00	.00	.00	.00	.00
52	500.00	.00	.00	.00	.00

SUGGESTIONS FOR THE MODIFICATION OF STANDARD SWOPSIM MODELS

Non-traded Products

Products can be forced to always equate domestic supply and demand (and therefore never be traded) by a programming trick in SuperCalc3. The model DEMO does this for MK which assumes that dairy farm milk is not ever traded. Figure 12 presents the equation modification (done by hand) to force the model to obey this constraint.

Figure 12--Equations to Prevent Trade in FM in DEMO-RW

```
DEMO-RW
W26       P= "LPRPRICE
W27       P= MAX(U27-N27+IF(AE27<0,P27,0)
             -IF(AE27>=0,Q27,0)+T27*(F27^J27)*(B27^K27),1)+.5*AQ27

DEMO-RW
AQ26       P= "MKADJ
AQ27       P= IF(ITER=1,0,AQ27-(W27*AH27/AC27))
```

Cell W27 adds to the current price calculation, half of the contents of cell AQ27 (underlined in figure 12). Cell AQ27, in turn, adds a small amount to itself if trade is negative and subtracts a small amount from itself if trade is positive. Thus, if trade is not equal to zero, then the price is adjusted

to make it equal zero. This iterative process occurs in conjunction with other simultaneous changes in a model.

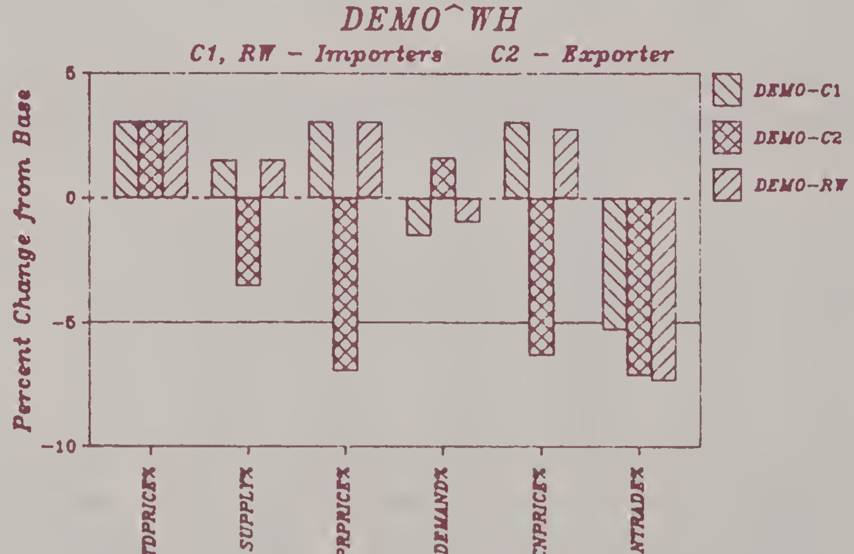
Quotas

The standard models contain columns for quotas but do not contain calculation devices for changing them in the context of a world solution. Equations to accomplish this must be added after the model equations have been created. For the situation where a future quota is to be imposed, the mechanics can be handled in a manner similar to the above procedure for dealing with non-traded products. The only difference is that changes in domestic prices have to be dependent on a comparison of current trade to the quota level via logical statements. There is more of a problem in dealing with quotas already in place, however. Here the standard model would have to be modified in such a way that it knew at what domestic price the quota would be ineffective. This means knowing, in effect, the tariff equivalent of the quota. If that is known, it can, of course be treated as a negative import subsidy equivalent in the standard model framework. Otherwise some tricky programming would be needed to install the quota as a policy manipulation tool into a model. The benefit of doing so has to be judged in each case and should be compared with the cost of extra spreadsheet programming. Similar comments apply to minimum prices, production quotas, etc. All of these devices can be programmed in but should be done carefully and probably only after the "subsidy equivalent" approach has been tried and found wanting.

Templates and Graphics

One of the main advantages of "spreadsheet" models is that all of the useful and simple technology of the spreadsheet is available for use with the models. For example, templates of tables, reports, graphs, indicators, etc. can be appended to models at will once the models themselves have been created and parameterized. These techniques make possible an almost instantaneous appraisal of the results of a policy change. As an example, figure 13 is a plot of the result of a removal of a hypothetical 10 percent export subsidy for WH in the DEMO exporting country C2. Note that the direction of changes of prices and quantities are identical with those shown in figure 3.

Figure 13--Graph of the Results From DEMO^WH Policy Change



Results: removal of 10 percent WH export subsidy in C2

Non-Net Trade Problems

The standard structure for a SWOPSIM model follows the logic of the net trade model. Essentially this type of model assumes that a domestic and traded good are perfect substitutes in consumption. A little imagination allows a user to modify this assumption in the SWOPSIM framework by defining separate products for specific purposes. For example, if a SWOPSIM model is to be used for the examination of bilateral trade flows, separate products can be defined for the bilateral situation and the "rest-of-the-world" situation. The separately defined products can be linked by cross price elasticities in the supply and demand equations which, in effect, define the extent of their non-substitutability.

CONCLUDING COMMENTS

If they are adequate to the task at hand, smaller SWOPSIM models are easier to work with than larger ones. Solution times will be slower and solution problems greater the larger the models become. This implies that a wise modeling strategy is to create small models which are just big enough to answer the question at hand. SWOPSIM is designed to allow researchers to assemble models rapidly from a store of elasticities and base data in order to analyze particular problems.

Flexibility of SWOPSIM models is limited only by the user's imagination. More complexity, such as inclusion of stock equations in agricultural models, can be done by adding equations to cells to the right of existing ones. Once customized changes have been entered into product rows of a country/region spreadsheet, they will be carried along as equations are updated or single or multi-product models are re-created.

As is true with any modeling scheme, the ultimate test is what is done with the framework in terms of the analysis of real problems. Further modification and documentation of SWOPSIM models will have to appear as the framework is applied to the problems of the day.

APPENDIX A--SWOPSIM COMPUTER PROGRAMS

Table A outlines the family of programs which create and modify SWOPSIM models. The table is followed by a listing of the master file and the programs themselves which use the master file to create SWOPSIM models. Comments within the programs provide documentation for a programmer. The programs all assume the input and output information is on the "D:" drive. This assumption can be changed by using a text editor to change to another drive designation in all programs.

Table A - SWOPSIM Computer Programs

Program	Function
Master.CAL	A master spreadsheet which defines the region and product coverage of a set of SWOPSIM models. This spreadsheet must be specified before any of the programs are run.
CREATE.BAT	A (batch) program which clears old models and invokes the CSHEET (basic) program.
CSHEET.BAS	The program, given the master file structure, creates a set of spreadsheets for each country marked in the master file. Each spreadsheet includes a place for elasticities, base data, and policy summaries in the form of subsidy equivalents.
EQUATION.BAT	This program invokes two basic programs (EQNA and EQNB) which replace existing model equations with new ones for a selected country/region. The equations include the elasticities currently documented in the country/region spreadsheet that is selected. If these elasticities are changed, this program and model creation programs need to be run again to incorporate the new elasticities.
EQNA.BAS	The first of the equation creation programs. This program reads the master file and writes out the elasticities from the selected country/region file.
EQNB.BAS	The second equation creation program calculates intercepts and writes them and new equations in appropriate cells of the selected spreadsheet. Old intercepts and equations are replaced.
COMODMOD.BAT	This program creates a world (multi-region) single product model in a spreadsheet from base data and equations in the country/region spreadsheets. If subsidy equivalents are changed, the product model spreadsheet can be solved for a new equilibrium by changing the world product price enough to clear the world market. Cross price effects are not included in the single product model.
COMOD.BAS	This basic program invoked by COMODMOD creates the world single product model spreadsheet.

Table A--concluded

WORLDMOD.BAT	This batch procedure clears the old world model away and creates a new multi-region multi-product model from the country/region spreadsheets. The world model contains all of the regions and products specified in the master file and includes all cross product effects.
WORLD.BAS	The basic program invoked by WORLDMOD which creates the full world SWOPSIM model.
AGCTY.BAT	A procedure which allows the aggregation of data across country/region spreadsheets. This is useful for checking, for example, on the consistency of the base data across countries/regions. If a single product does not have balanced world trade in the base period, any model spreadsheet will begin to solve even if no policy changes have been introduced.
AGCTY.BAS	The basic program invoked by AGCTY.

Program Listings

These program listings expect SuperCalc3 to be on the logged drive and assume the programs themselves, spreadsheets, etc. are on the D: drive. "D:" can be globally edited in all programs and procedures to obtain other drive designations.

CREATE.BAT

Give four letter name of master spreadsheet file (e.g. CREATE DEMO).

```
ERASE D:%1-??.*
ERASE D:%1^??.*
BASIC D:CSHEET
SDIR D:??.XQT
D:LOAD
```

CSHEET.BAS

```
10 REM - CSHEET - CREATE COUNTRY/REGION SPREADSHEETS FROM MASTER FILE SPECS.
20 CLS 'XQT FILE IS CREATED FOR EACH COUNTRY/REGION IN MASTER FILE
30 PRINT"PROGRAM TO CREATE NEW BLANK COUNTRY/REGION SPREADSHEETS FROM MASTER"
40 PRINT"FILE (SPREADSHEET).  THIS PROGRAM WILL REPLACE OLD SPREADSHEETS - "
50 PRINT"ELASTICITIES AND BASE DATA MUST BE ADDED TO THE NEW SPREADSHEETS IN"
60 PRINT"ORDER TO CREATE CONSTANTS AND EQUATIONS WITH THE 'EQUATION'"
70 PRINT"PROGRAM.":PRINT
80 PRINT:INPUT"ENTER NAME OF MASTER FILE";FILE$
90 IF LEN(FILE$)<>4 THEN 20 'MASTER FILE NAME MUST BE 4 CHARACTERS
100 NAM$=FILE$+"-"
110 PRINT:PRINT"READING MASTER FILE - ";FILE$:PRINT
120 DIM PRM$(0,122) 'MASTER FILE CAN CONTAIN UP TO 50 PRODUCT GROUPS
130 DIM CYM$(0,41) 'MASTER FILE CAN CONTAIN UP TO 41 COUNTRIES/REGIONS
140 CL$=" A B C D E F G H I J K L M N O P Q R S T U V W X Y
```

```
ZAAABACADAEAFAGAHAIAJAKALAMANAOAPAQARASATAUAVAWAXAYAZBABBBCBDBEBFBGBHBIBJBKBLB
MBNBOBPBQBRBSBTBUBVBWBXBYBZCACBCCCDCECFCGCHCICJCKCLCMCNCOCPCQCRCSCTCUCVCWCXCYC
ZDADBDCDDDEDFDGDHDIDJDKDLDMDNDODPDQDR"
150 LCL=LEN(CL$)/2
160 DIM CLM$(0,122)
170 FOR I=1 TO LCL '122 COLUMNS MAX.
180 CLM$(0,I)=MID$(CL$,(I-1)*2+1,2):NEXT I
190 F$="D:"+FILE$+".PRN"
200 OPEN"I",1,F$
210 DIM D(122,41)
220 LINE INPUT #1,W$ 'BEGIN READING TLIB.PRN MASTER FILE
230 LINE INPUT #1,W$
240 LINE INPUT #1,W$
250 LINE INPUT #1,W$
260 LINE INPUT #1,CY$
270 LINE INPUT #1,W$
280 STAR=(INSTR(CY$,"-")-11)/3
290 LCY=(LEN(CY$)-8)/3
300 IF STAR < LCY THEN LCY=STAR
310 PRINT:PRINT"COUNTRIES/REGIONS ARE:":PRINT
320 FOR I=1 TO LCY
330 CYM$(0,I)=MID$(CY$,(I-1)*3+10,2):PRINT CYM$(0,I);" ";:NEXT I:PRINT
340 LPR=0
350 PRINT:PRINT"PRODUCT GROUPS ARE:":PRINT
360 LPR=LPR+1
370 LINE INPUT#1,W$
380 WP$=MID$(W$,5,4)
390 PBLANK=INSTR(WP$," "):IF PBLANK=0 THEN 410
400 WP$=RIGHT$(WP$,LEN(WP$)-1):GOTO 390
410 IF MID$(W$,7,2)=" ^" OR MID$(W$,7,2)="  " THEN 490 ELSE
PRM$(0,LPR)=WP$:PRINT PRM$(0,LPR);" ";
420 FOR J=1 TO LCY 'PUT ONE, TWO, THREE, FOUR OR ZERO IN D MATRIX FOR EACH ROW
430 X$=MID$(W$,(J-1)*3+9,3)
440 IF X$="  D" THEN X$="  2"
450 IF X$="  S" THEN X$="  3"
460 IF X$=" SD" OR X$=" DS" THEN X$="  4"
470 D(LPR,J)=VAL(X$):NEXT J
480 GOTO 360
490 CLOSE 1
500 OPEN"O",1,"D:LOAD.BAT"
510 FOR I=1 TO LCY
520 W$="SC3 D:"+CYM$(0,I):GOSUB 2520
530 W$="ERASE D:"+CYM$(0,I)+".XQT":GOSUB 2520
540 NEXT I
550 CLOSE 1
560 PRINT:PRINT
570 LPR=LPR-1
580 PRINT"CONTINUING . . . . . . . .":PRINT
590 GOSUB 1300
600 FOR K=1 TO LCY 'MAJOR LOOP TO CREATE FILE FOR EACH COUNTRY/REGION
610 FOR I=1 TO LPR 'CHECK WHETHER ANY PRODUCT IS INCLUDED FOR COUNTRY/REGION
620 IF D(I,K)>0 THEN 650
630 NEXT I
640 GOTO 2480 'IF NO PRODUCT, THEN SKIP COUNTRY/REGION
650 F$="D:"+CYM$(C,K)+".XQT"
```

```
660 OPEN"O",1,F$
670 W$="/GN":GOSUB 2520 'BEGIN WRITING SUPERCALC COMMANDS TO XQT FILE
680 W$="/GM":GOSUB 2520
690 W$="/FCA,TR":GOSUB 2520
700 W$="=A1":GOSUB 2520
710 W$=CHR$(34)+NAM$+CYM$(0,K):GOSUB 2510
720 W$="=C1":GOSUB 2520
730 W$=CHR$(34)+"XRATE (LC/US$) = ":GOSUB 2510
740 W$="=E1":GOSUB 2520
750 W$="0":GOSUB 2520
760 W$="=H1":GOSUB 2520
770 W$=CHR$(34)+"XRATE ELASTICITY = ":GOSUB 2510
780 W$="=J1":GOSUB 2520
790 W$="0":GOSUB 2520
800 W$="=A3":GOSUB 2520
810 W$=CHR$(34)+"SUPPLY EL":GOSUB 2510
820 W$="/FR3,TR":GOSUB 2520
830 FOR I=1 TO LPR:IF D(I,K)=0 THEN 860 'WRITE SUPPLY ELAST. MATRIX COL. HEADS
840 W$="="+CLM$(0,I+1)+"3":GOSUB 2520
850 W$=CHR$(34)+PRM$(0,I):GOSUB 2510
860 NEXT I
870 LG=0
880 FOR I=1 TO LPR:IF D(I,K)=3 OR D(I,K)=4 THEN 890 ELSE 910 'ADD D. VAR. TO
S.
890 LG=LG+1:W$="="+CLM$(0,LPR+1+LG)+"3":GOSUB 2520
900 W$=CHR$(34)+"D"+PRM$(0,I):GOSUB 2510
910 NEXT I
920 FOR I=1 TO LPR 'WRITE SUPPLY MATRIX ROW
930 IF D(I,K)=0 THEN 1020
940 W$="=A"+STR$(I+3):GOSUB 2520
950 W$=CHR$(34)+PRM$(0,I):GOSUB 2510
960 FOR J=1 TO LPR 'WRITE COLUMN OF ZERO ELASTICITIES FOR SUPPLY MATRIX ROW
970 IF D(J,K)=0 THEN 1010
980 W$="="+CLM$(0,J+1)+STR$(I+3):GOSUB 2520
990 W$="0":GOSUB 2520
1000 W$="/FE"+CLM$(0,J+1)+STR$(I+3)+",$":GOSUB 2520
1010 NEXT J
1020 NEXT I
1030 W$="=A"+STR$(LPR+5):GOSUB 2520
1040 W$=CHR$(34)+"DEMAND EL":GOSUB 2510
1050 W$="/FR"+STR$(LPR+5)+",TR":GOSUB 2520
1060 FOR I=1 TO LPR:IF D(I,K)=0 THEN 1090 'WRITE DEM. ELAST. MATRIX COL. HEADS
1070 W$="="+CLM$(0,I+1)+STR$(LPR+5):GOSUB 2520
1080 W$=CHR$(34)+PRM$(0,I):GOSUB 2510
1090 NEXT I
1100 LF=0
1110 FOR I=1 TO LPR:IF D(I,K)=2 OR D(I,K)=4 THEN 1120 ELSE 1140 'S. VAR. TO D.
1120 LF=LF+1:W$="="+CLM$(0,LPR+1+LF)+STR$(LPR+5):GOSUB 2520
1130 W$=CHR$(34)+"S"+PRM$(0,I):GOSUB 2510
1140 NEXT I
1150 FOR I=1 TO LPR 'WRITE DEMAND ELASTICITY ROW
1160 IF D(I,K)=0 THEN 1250
1170 W$="=A"+STR$(I+LPR+5):GOSUB 2520
1180 W$=CHR$(34)+PRM$(0,I):GOSUB 2510
1190 FOR J=1 TO LPR 'WRITE COLUMN OF ZERO ELASTICITIES FOR SUPPLY MATRIX ROW
```

```
1200 IF D(J,K)=0 THEN 1240
1210 W$="="+CLM$(0,J+1)+STR$(I+LPR+5):GOSUB 2520
1220 W$="0":GOSUB 2520
1230 W$="/FE"+CLM$(0,J+1)+STR$(I+LPR+5)+",$":GOSUB 2520
1240 NEXT J
1250 NEXT I
1260 W$="=A"+STR$(2*LPR+8):GOSUB 2510 'BEGIN TO WRITE DATA PART OF SPREADSHEET
1270 W$=CHR$(34)+NAM$+CYM$(0,K):GOSUB 2510
1280 W$="/FR"+STR$(2*LPR+8)+",TR":GOSUB 2520
1290 GOTO 1730
1300 DIM N$(0,42) 'SUBROUTINE TO CREATE DATA COLUMN HEADS
1310 N$(0,1)="WDPRICE"   'B
1320 N$(0,2)="PRPRICE"   'C
1330 N$(0,3)="CNPRICE"   'D
1340 N$(0,4)="TDPRICE"   'E
1350 N$(0,5)="XRATE"     'F
1360 N$(0,6)="SUPPLY"    'G
1370 N$(0,7)="DEMAND"    'H
1380 N$(0,8)="NTRADE"    'I
1390 N$(0,9)="XRATE EL"  'J
1400 N$(0,10)="WDPT.EL"  'K
1410 N$(0,11)="SSHIFT"   'L
1420 N$(0,12)="DSHIFT"   'M
1430 N$(0,13)="PRSUBEQ"  'N
1440 N$(0,14)="CNSUBEQ"  'O
1450 N$(0,15)="IMSUBEQ"  'P
1460 N$(0,16)="EXSUBEQ"  'Q
1470 N$(0,17)="IMQUOTA"  'R
1480 N$(0,18)="EXQUOTA"  'S
1490 N$(0,19)="TDCONST"  'T
1500 N$(0,20)="PRCONST"  'U
1510 N$(0,21)="CNCONST"  'V
1520 N$(0,22)="LPRPRICE" 'W
1530 N$(0,23)="LCNPRICE" 'X
1540 N$(0,24)="SCROSS"   'Y
1550 N$(0,25)="DCROSS"   'Z
1560 N$(0,26)="SCONST"   'AA
1570 N$(0,27)="DCONST"   'AB
1580 N$(0,28)="SUPPLYEQ" 'AC
1590 N$(0,29)="DEMANDEQ" 'AD
1600 N$(0,30)="NTRADEEQ" 'AE
1610 N$(0,31)="SUPPLYD"  'AF
1620 N$(0,32)="DEMANDD"  'AG
1630 N$(0,33)="NTRADED"  'AH
1640 N$(0,34)="PRPRICED" 'AI
1650 N$(0,35)="CNPRICED" 'AJ
1660 N$(0,36)="TDPRICE%" 'AK
1670 N$(0,37)="SUPPLY%"  'AL
1680 N$(0,38)="PRPRICE%" 'AM
1690 N$(0,39)="DEMAND%"  'AN
1700 N$(0,40)="CNPRICE%" 'AO
1710 N$(0,41)="NTRADE%"  'AP
1720 RETURN
1730 FOR I=1 TO 41 'WRITE DATA COLUMN HEADS ON SPREADSHEET
1740 W$="="+CLM$(0,I+1)+STR$(2*LPR+8):GOSUB 2520
```

```
1750 W$=CHR$(34)+N$(0,I):GOSUB 2510
1760 NEXT I
1770 FOR I=1 TO LPR 'LOOP TO WRITE DATA COLUMN FOR EACH PRODUCT GROUP
1780 IF D(I,K)=0 THEN 2410 'SKIP ROW IF PRODUCT NOT INCLUDED FOR COUNTRY
1790 S$=RIGHT$(STR$(I+2*LPR+8),LEN(STR$(I+2*LPR+8))-1) 'SELECT ROW
1800 W$="=A"+S$:GOSUB 2520
1810 W$=CHR$(34)+PRM$(0,I):GOSUB 2510
1820 T$=STR$(I+4)
1830 W$="=B"+S$:GOSUB 2520 'LOAD WDPRICE FROM MASTER FILE
1840 W$="/LD:"+FILE$+",PAR"+T$+":AR"+T$+",B"+S$:GOSUB 2510
1850 W$="=C"+S$:GOSUB 2520 'WRITE ZERO WHERE DATA IS TO BE ENTERED
1860 W$="0":GOSUB 2520
1870 W$="=D"+S$:GOSUB 2520 'WRITE ZERO WHERE DATA IS TO BE ENTERED
1880 W$="0":GOSUB 2520
1890 W$="=E"+S$:GOSUB 2520 'WRITE ZERO WHERE DATA IS TO BE ENTERED
1900 W$="0":GOSUB 2520
1910 W$="=F"+S$:GOSUB 2520 'XRATE FROM TOP OF SHEET
1920 W$="E1":GOSUB 2510
1930 W$="=G"+S$:GOSUB 2520 'PUT ZERO WHERE DATA IS TO BE ENTERED
1940 W$="0":GOSUB 2520
1950 W$="=H"+S$:GOSUB 2520 'PUT ZERO WHERE DATA IS TO BE ENTERED
1960 W$="0":GOSUB 2520
1970 W$="=I"+S$:GOSUB 2520 'NET TRADE
1980 W$="G"+S$+"-H"+S$:GOSUB 2510
1990 W$="=J"+S$:GOSUB 2520 'XRATE EL FROM TOP OF SHEET
2000 W$="J1":GOSUB 2510
2010 W$="=K"+S$:GOSUB 2520 'SET WORLD PRICE TRANSMISSION ELASTICITY TO 1
2020 W$="1":GOSUB 2520
2030 W$="=L"+S$:GOSUB 2520 'COLUMN FOR SUPPLY SHIFT%
2040 W$="0":GOSUB 2530
2050 W$="=M"+S$:GOSUB 2520 'COLUMN FOR DEMAND SHIFT%
2060 W$="0":GOSUB 2530
2070 W$="=T"+S$:GOSUB 2520 'TRADE PRICE CONSTANT
2080 W$="E"+S$+"/((F"+S$+"^J"+S$+")*(B"+S$+"^K"+S$+"))":GOSUB 2510
2090 W$="=U"+S$:GOSUB 2520 'PRODUCER PRICE CONSTANT
2100 W$="C"+S$+"-E"+S$:GOSUB 2510
2110 W$="=V"+S$:GOSUB 2520 'CONSUMER PRICE CONSTANT
2120 W$="D"+S$+"-C"+S$:GOSUB 2510
2130 W$="=W"+S$:GOSUB 2520 'LIBERALIZED PRODUCER PRICE
2140 W$="MAX(U"+S$+"-N"+S$+"+IF(AE"+S$+"<0,P"+S$+",0)"+"-
IF(AE"+S$+">=0,Q"+S$+",0)"+"+"+T"+S$+"*(F"+S$+"^J"+S$+")*(B"+S$+"^K"+S$+"),1)":G
OSUB 2510
2150 W$="=X"+S$:GOSUB 2520 'LIBERALIZED CONSUMER PRICE
2160 W$="MAX(W"+S$+"+N"+S$+"+O"+S$+"+V"+S$+",1)":GOSUB 2510
2170 W$="=AE"+S$:GOSUB 2520 'NET TRADE EQUATION
2180 W$="AC"+S$+"-AD"+S$:GOSUB 2510
2190 W$="=AF"+S$:GOSUB 2520 'SUPPLY DIFFERENCE
2200 W$="AC"+S$+"-G"+S$:GOSUB 2540
2210 W$="=AG"+S$:GOSUB 2520 'DEMAND DIFFERENCE
2220 W$="AD"+S$+"-H"+S$:GOSUB 2540
2230 W$="=AH"+S$:GOSUB 2520 'NET TRADE DIFFERENCE
2240 W$="AE"+S$+"-I"+S$:GOSUB 2540
2250 W$="=AI"+S$:GOSUB 2520 'PRODUCER PRICE DIFFERENCE
2260 W$="W"+S$+"-C"+S$:GOSUB 2510
2270 W$="=AJ"+S$:GOSUB 2520 'CONSUMER PRICE DIFFERENCE
```

```
2280 W$="X"+S$+"-D"+S$:GOSUB 2510
2290 W$="=AK"+S$:GOSUB 2520 '% CHANGE IN TRADE PRICE
2300 W$="((T"+S$+"*(F"+S$+"^J"+S$+")*(B"+S$+"^K"+S$+"))-
E"+S$+")*100/E"+S$:GOSUB 2530
2310 W$="=AL"+S$:GOSUB 2520 '% CHANGE IN SUPPLY
2320 W$="AF"+S$+"*100/G"+S$:GOSUB 2530
2330 W$="=AM"+S$:GOSUB 2520 '% CHANGE IN PRODUCER PRICE
2340 W$="AI"+S$+"*100/C"+S$:GOSUB 2530
2350 W$="=AN"+S$:GOSUB 2520 '% CHANGE IN DEMAND
2360 W$="AG"+S$+"*100/H"+S$:GOSUB 2530
2370 W$="=AO"+S$:GOSUB 2520 '% CHANGE IN CONSUMER PRICE
2380 W$="AJ"+S$+"*100/D"+S$:GOSUB 2530
2390 W$="=AP"+S$:GOSUB 2520 '% CHANGE IN NET TRADE
2400 W$="AH"+S$+"*100/I"+S$:GOSUB 2530
2410 NEXT I
2420 W$="=A1":GOSUB 2520
2430 W$="!":GOSUB 2520
2440 W$="/SD:"+NAM$+CYM$(0,K)+",A":GOSUB 2520 'SAVE THE SPREADSHEET
2450 REM W$="/ODA1:AP"+S$+",DD:"+NAM$+CYM$(0,K):GOSUB 2490 'SAVE PRN
SPREADSHEET
2460 W$="/Q,Y":GOSUB 2520
2470 CLOSE 1
2480 NEXT K 'END OF LOOP FOR EACH PRODUCT GROUP
2490 SYSTEM
2500 END
2510 PRINT #1,W$:PRINT #1,"/P":RETURN 'WRITE TO SHEET AND PROTECT CELL
2520 PRINT #1,W$:RETURN 'WRITE TO SHEET
2530 PRINT #1,W$:PRINT #1,"/FE,$":PRINT #1,"/P":RETURN 'WRITE TO SHEET,
PROTECT AND USE $ FORMAT
2540 PRINT #1,W$:PRINT #1,"/FE,I":PRINT #1,"/P":RETURN 'WRITE TO SHEET,
PROTECT AND USE INTEGER FORMAT
```

EQUATION.BAT

Give the 4 letter name of master spreadsheet (e.g. EQUATION DEMO).

```
SDIR D:%1-??.CAL
ERASE D:TEST.PRN
ERASE D:???.PRN
ERASE D:%1-??.PRN
BASIC D:EQNA
SC3 D:TEST
ERASE D:TEST.XQT
BASIC D:EQNB
SC3 D:TEST
ERASE D:TEST.XQT
ERASE D:TEST.TXT
ERASE D:TEST.CAL
ERASE D:SUP.PRN
ERASE D:DEM.PRN
SDIR D:%1-??.CAL
```

EQNA.BAS

```
10 REM - EQNA - PART A, CREATE EQUATIONS FOR COUNTRY/REGION MODEL
```

```
20 REM COUNTRY/REGION SPREADSHEETS MUST HAVE BASE PRICE AND QUANTITY DATA
ADDED TO THEM BEFORE THIS PROGRAM IS RUN
30 CLS 'SUP AND DEM PRINT FILES ARE TEMPORARILY CREATED
40 PRINT"PROGRAM TO SELECT A COUNTRY/REGION FOR EQUATION WRITING":PRINT
50 PRINT"ELASTICITIES AND BASE DATA HAVE TO BE ADDED TO COUNTRY/REGION"
60 PRINT"FILES BEFORE THIS PROGRAM IS RUN.":PRINT
70 PRINT:INPUT"ENTER NAME OF MASTER FILE";FILE$
80 NAM$=FILE$+"-"
90 IF LEN(FILE$)<>4 THEN 30
100 PRINT:PRINT"READING MASTER FILE - ";FILE$:PRINT
110 DIM PRM$(0,122) 'MASTER FILE CAN CONTAIN UP TO 70 PRODUCT GROUPS
120 REM AN ELASTICITY LESS THAN -9.999 OR GREATER THAN 99.99 CAN CAUSE AN
ERROR
130 REM IN THE EQUATION GENERATION PROCEDURE.  LARGE PRODUCT SETS AND
RESULTING
140 REM LARGE ELASTICITY MATRICES NEED LONGER PROGRAM RUNNING TIMES
150 DIM CYM$(0,41) 'MASTER FILE CAN CONTAIN UP TO 41 COUNTRIES/REGIONS
160 CL$=" A B C D E F G H I J K L M N O P Q R S T U V W X Y
ZAAABACADAEAFAGAHAIAJAKALAMANAOAPAQARASATAUAVAWAXAYAZBABBBCBDBEBFBGBHBIBJBKBLB
MBNBOBPBQBRBSBTBUBVBWBXBYBZCACBCCCDCECFCGCHCICJCKCLCMCNCOCPCQCRCSCTCUCVCWCXCYC
ZDADBDCDDDEDFDGDHDIDJDKDLDMDNDODPDQDR"
170 LCL=LEN(CL$)/2
180 DIM CLM$(0,122)
190 FOR I=1 TO LCL '122 COLUMNS MAX.
200 CLM$(0,I)=MID$(CL$,(I-1)*2+1,2):NEXT I
210 F$="D:"+FILE$+".PRN"
220 OPEN"I",1,F$
230 DIM D(122,41)
240 LINE INPUT #1,W$ 'BEGIN READING TLIB.PRN MASTER FILE
250 LINE INPUT #1,W$
260 LINE INPUT #1,W$
270 LINE INPUT #1,W$
280 LINE INPUT #1,CY$
290 LINE INPUT #1,W$
300 STAR=(INSTR(CY$,"-")-11)/3
310 LCY=(LEN(CY$)-8)/3
320 IF STAR < LCY THEN LCY=STAR
330 FOR I=1 TO LCY
340 CYM$(0,I)=MID$(CY$,(I-1)*3+10,2):NEXT I
350 LPR=0
360 PRINT:PRINT"PRODUCT GROUPS ARE:":PRINT
370 LPR=LPR+1
380 LINE INPUT#1,W$
390 WP$=MID$(W$,5,4)
400 PBLANK=INSTR(WP$," "):IF PBLANK=0 THEN 420
410 WP$=RIGHT$(WP$,LEN(WP$)-1):GOTO 400
420 IF MID$(W$,7,2)=" ^" OR MID$(W$,7,2)="  " THEN 500 ELSE
PRM$(0,LPR)=WP$:PRINT PRM$(0,LPR);" ";
430 FOR J=1 TO LCY 'PUT ONE, TWO, THREE, FOUR OR ZERO IN D MATRIX FOR EACH ROW
440 X$=MID$(W$,(J-1)*3+9,3)
450 IF X$="  D" THEN X$="  2"
460 IF X$="  S" THEN X$="  3"
470 IF X$=" SD" OR X$=" DS" THEN X$="  4"
480 D(LPR,J)=VAL(X$):NEXT J
490 GOTO 370
```

```
500 PRINT:CLOSE 1:LPR=LPR-1
510 PRINT:PRINT:PRINT"COUNTRIES/REGIONS ARE:":PRINT
520 FOR I=1 TO LCY:PRINT CYM$(0,I);" ";:NEXT I:PRINT
530 PRINT:PRINT:PRINT:INPUT"ENTER 2 DIGIT COUNTRY/REGION CODE";CY$
540 FOR JC=1 TO LCY 'COUNTRY/REGION IS PEGGED AND CHECKED
550 IF CY$=CYM$(0,JC) THEN 580
560 NEXT JC
570 GOTO 510
580 LF=0:LG=0 'COUNT NUMBER OF QUANTITIES INLCUDED IN S & D EQUATIONS
590 DIM DEMQT(50),SUPQT(50):IDPOS=0:ISPOS=0
600 FOR I=1 TO LPR: IF D(I,JC)=2 OR D(I,JC)=4 THEN 610 ELSE 640
610 LF=LF+1
620 IDPOS=IDPOS+1
630 DEMQT(IDPOS)=I
640 IF D(I,JC)=3 OR D(I,JC)=4 THEN 650 ELSE 680
650 LG=LG+1
660 ISPOS=ISPOS+1
670 SUPQT(ISPOS)=I
680 NEXT I
690 PRINT
700 OPEN"O",1,"D:TEST.TXT"
710 W$=NAM$+CY$
720 PRINT #1,W$
730 PRINT #1,LPR
740 PRINT #1,LG
750 FOR I=1 TO LG
760 PRINT #1,SUPQT(I):NEXT I
770 PRINT #1,LF
780 FOR I=1 TO LF
790 PRINT #1,DEMQT(I):NEXT I
800 FOR I=1 TO LPR
810 PRINT #1,PRM$(0,I):NEXT I
820 CLOSE 1
830 OPEN"O",1,"D:TEST.XQT" 'WRITE OUT XQT FILE TO GET ELASTICITY MATRICES
840 W$="/LD:"+NAM$+CY$+",A":GOSUB 1000
850 W$="/GB":GOSUB 1000
860 BC$="B"
870 ECD$=CLM$(0,LPR+1+LF)
880 ECS$=CLM$(0,LPR+1+LG)
890 BR$="4"
900 ER$=RIGHT$(STR$(3+LPR),LEN(STR$(3+LPR))-1)
910 W$="/FG6":GOSUB 1000
920 W$="/OD"+BC$+BR$+":"+ECS$+ER$+",DD:SUP":GOSUB 1000
930 BR$=RIGHT$(STR$(3+LPR+3),LEN(STR$(3+LPR+3))-1)
940 ER$=RIGHT$(STR$(3+LPR+2+LPR),LEN(STR$(3+LPR+2+LPR))-1)
950 W$="/OD"+BC$+BR$+":"+ECD$+ER$+",DD:DEM":GOSUB 1000
960 W$="/Q,Y":GOSUB 1000
970 CLOSE 1
980 SYSTEM
990 END
1000 PRINT #1,W$:RETURN
```

<u>EQNB.BAS</u>

```
10 REM - EQNB - PART B, CREATE CONSTANTS AND EQUATIONS FOR COUNTRY/REGION
```

```
20 REM COUNTRY/REGION SPREADSHEETS MUST HAVE BASE PRICE AND QUANTITY DATA
ADDED TO THEM BEFORE THIS PROGRAM IS RUN
30 CLS 'A COUNTRY/REGION IS SELECTED AND AN XQT FILE OF EQUATIONS IS CREATED
40 OPEN"I",1,"D:TEST.TXT"
50 DIM SUPQT(70),DEMQT(70)
60 INPUT #1,CY$:
70 INPUT #1,LPR
80 INPUT #1,LG
90 FOR I=1 TO LG
100 INPUT #1,SUPQT(I):NEXT I
110 INPUT #1,LF
120 FOR I=1 TO LF
130 INPUT #1,DEMQT(I):NEXT I
140 PRINT:PRINT"DOING STUFF FOR MODEL SHEET ---> ";CY$:PRINT
150 CLOSE 1
160 DIM SUP$(7,70),DEM$(7,70)
170 OPEN"I",1,"D:SUP.PRN"
180 J1=0
190 FOR J=1 TO LPR +LG STEP 22 'READ IN SUPPLY ELASTICITIES
200 J1=J1+1
210 FOR I=1 TO LPR
220 LINE INPUT #1,W$:SUP$(J1,I)=W$:NEXT I
230 NEXT J
240 CLOSE 1:OPEN"I",1,"D:DEM.PRN":J1=0
250 FOR J=1 TO LPR +LF STEP 22 'READ IN DEMAND ELASTICITIES
260 J1=J1+1
270 FOR I=1 TO LPR
280 LINE INPUT #1,W$:DEM$(J1,I)=W$:NEXT I
290 NEXT J
300 CLOSE 1
310 OPEN"O",1,"D:TEST.XQT"
320 W$="/LD:"+NA$+CY$+",A":GOSUB 1060
330 W$="/UY"+STR$(9+2*LPR)+":AD"+STR$(9+3*LPR):GOSUB 1060
340 W$="/CG"+STR$(9+2*LPR)+":H"+STR$(9+3*LPR)+",AC"+STR$(9+2*LPR)+",V":GOSUB
1060
350 W$="/UAC"+STR$(9+2*LPR)+":AD"+STR$(9+3*LPR):GOSUB 1060
360 FOR I=1 TO LPR 'MAJOR LOOP GOING THROUGH PRODUCTS
370 FOR J=1 TO LPR +LG 'CHECK TO SEE IF PRODUCT ROW HAS ANY ELASTICITIES
380 J2=FIX(J/23)+1
390 J3=J-(J2-1)*22
400 IF MID$(SUP$(J2,I),(J3-1)*6+4,3)<>"   " THEN 430
410 NEXT J
420 GOTO 940
430 SI$=RIGHT$(STR$(I+2*LPR+8),LEN(STR$(I+2*LPR+8))-1)
440 W$="=Y"+SI$:GOSUB 1060 'SUPPLY CROSS EFFECT
450 W$="1*"
460 FOR J=1 TO LPR +LG
470 J2=FIX(J/23)+1
480 J3=J-(J2-1)*22
490 IF VAL(MID$(SUP$(J2,I),(J3-1)*6+3,4))=0 OR I=J THEN 560
500 IF J<=LPR THEN J1=J ELSE J1=SUPQT(J-LPR)
510 SJ$=RIGHT$(STR$(J1+2*LPR+8),LEN(STR$(J1+2*LPR+8))-1)
520 IF J<=LPR THEN 550
530 W$=W$+"(AD"+SJ$+"^"+MID$(SUP$(J2,I),(J3-1)*6+2,5)+")*"
540 GOTO 560
```

```
550 W$=W$+"(W"+SJ$+"^"+MID$(SUP$(J2,I),(J3-1)*6+2,5)+")*"
560 NEXT J
570 IF LEN(W$)<>0 THEN W$=LEFT$(W$,LEN(W$)-1)
580 GOSUB 1060
590 W$="=Z"+SI$:GOSUB 1060 'DEMAND CROSS EFFECT
600 W$="1*"
610 FOR J=1 TO LPR + LF
620 J2=FIX(J/23)+1
630 J3=J-(J2-1)*22
640 IF VAL(MID$(DEM$(J2,I),(J3-1)*6+3,4))=0 OR I=J THEN 710
650 IF J<=LPR THEN J1=J ELSE J1=DEMQT(J-LPR)
660 SJ$=RIGHT$(STR$(J1+2*LPR+8),LEN(STR$(J1+2*LPR+8))-1)
670 IF J<=LPR THEN 700
680 W$=W$+"(AC"+SJ$+"^"+MID$(DEM$(J2,I),(J3-1)*6+2,5)+")*"
690 GOTO 710
700 W$=W$+"(X"+SJ$+"^"+MID$(DEM$(J2,I),(J3-1)*6+2,5)+")*"
710 NEXT J
720 IF LEN(W$)<>0 THEN W$=LEFT$(W$,LEN(W$)-1)
730 GOSUB 1060
740 W$="=AA"+SI$:GOSUB 1060 'SUPPLY CONST
750 W$="G"+SI$+"/(Y"+SI$+"*"
760 I2=FIX(I/23)+1
770 I3=I-(I2-1)*22
780 IF VAL(MID$(SUP$(I2,I),(I3-1)*6+3,4))=0 THEN 800
790 W$=W$+"(C"+SI$+"^"+MID$(SUP$(I2,I),(I3-1)*6+2,5)+")*"
800 W$=LEFT$(W$,LEN(W$)-1)
810 W$=W$+")":GOSUB 1060
820 W$="=AB"+SI$:GOSUB 1060 'DEMAND CONST
830 W$="H"+SI$+"/(Z"+SI$+"*"
840 IF VAL(MID$(DEM$(I2,I),(I3-1)*6+3,4))=0 THEN 860
850 W$=W$+"(D"+SI$+"^"+MID$(DEM$(I2,I),(I3-1)*6+2,5)+")*"
860 W$=LEFT$(W$,LEN(W$)-1)
870 W$=W$+")":GOSUB 1060
880 W$="!":GOSUB 1060
890 W$="/SD:TEST,PAA"+STR$(9+2*LPR)+":AB"+SI$
900 W$="=AC"+SI$:GOSUB 1060 'SUPPLY EQUATION
910 W$="(1+L"+SI$+")*AA"+SI$+"*Y"+SI$+"*W"+SI$+"^"+MID$(SUP$(I2,I),(I3-
1)*6+2,5):GOSUB 1060
920 W$="=AD"+SI$:GOSUB 1060 'DEMAND EQUATION
930 W$="(1+M"+SI$+")*AB"+SI$+"*Z"+SI$+"*X"+SI$+"^"+MID$(DEM$(I2,I),(I3-
1)*6+2,5):GOSUB 1060
940 NEXT I
950 W$="!":GOSUB 1060
960 W$="/SD:TEST,PAA"+STR$(9+2*LPR)+":AB"+SI$+",V":GOSUB 1060
970 W$="/LD:TEST,PAA"+STR$(9+2*LPR)+":AB"+SI$+",AA"+STR$(9+2*LPR)+",V":GOSUB
1060
980 W$="=A1":GOSUB 1060
990 W$="/PY"+STR$(9+2*LPR)+":AD"+SI$:GOSUB 1060
1000 W$="/SD:"+CY$+",OA":GOSUB 1060 'SAVE SPREADSHEET WITH EQUATIONS
1010 REM W$="/ODA1:AP"+SI$+",DD:"+CY$:GOSUB 1060 'SAVE PRINT FILE OF SHEET
1020 W$="/Q,Y":GOSUB 1060
1030 CLOSE 1
1040 SYSTEM
1050 END
1060 LL=INSTR(W$," ") 'SUBROUTINE TO REMOVE BLANKS AND WRITE OUT STRING
```

```
1070 IF LL=0 THEN 1090
1080 W$=LEFT$(W$,LL-1)+RIGHT$(W$,LEN(W$)-LL):GOTO 1060
1090 PRINT #1,W$:RETURN
```

COMODMOD.BAT

Give 4 letter name of master spreadsheet file (e.g. COMODMOD DEMO).

```
SDIR D:%1^??.CAL
ERASE D:TEST.XQT
BASIC D:COMOD
D:TEST
```

COMOD.BAS

```
10 REM - COMOD - CREATE WORLD PRODUCT SPREADSHEET FOR SELECTED PRODUCT
20 REM COUNTRY/REGION SPREADSHEETS MUST HAVE BASE PRICE AND QUANTITY DATA
ADDED TO THEM BEFORE THIS PROGRAM IS RUN
30 CLS 'XQT FILE IS CREATED FOR PRODUCT SELECTED FROM MASTER FILE
40 PRINT"PROGRAM TO CREATE A WORLD PRODUCT MODEL FROM COUNTRY/REGION"
50 PRINT"SPREADSHEETS.  THE SPREADSHEETS SHOULD HAVE ELASTICITIES, BASE DATA,"
60 PRINT"AND EQUATIONS ADDED TO THEM BEFORE THIS PROGRAM IS RUN."
70 PRINT:INPUT"ENTER NAME OF MASTER FILE";FILE$
80 IF LEN(FILE$)<>4 THEN 30
90 NAM$=FILE$+"-"
100 NAMC$=FILE$+"^"
110 PRINT:PRINT"READING MASTER FILE - ";FILE$:PRINT
120 DIM PRM$(0,122) 'MASTER FILE CAN CONTAIN UP TO 122 PRODUCT GROUPS
130 DIM CYM$(0,41) 'MASTER FILE CAN CONTAIN UP TO 41 COUNTRIES/REGIONS
140 CL$=" A B C D E F G H I J K L M N O P Q R S T U V W X Y
ZAAABACADAEAFAGAHAIAJAKALAMANAOAPAQARASATAUAVAWAXAYAZBABBBCBDBEBFBGBHBIBJBKBLB
MBNBOBPBQBRBSBTBUBVBWBXBYBZCACBCCCDCECFCGCHCICJCKCLCMCNCOCPCQCRCSCTCUCVCWCXCYC
ZDADBDCDDDEDFDGDHDIDJDKDLDMDNDODPDQDR"
150 LCL=LEN(CL$)/2
160 DIM CLM$(0,122)
170 FOR I=1 TO LCL '122 COLUMNS MAX.
180 CLM$(0,I)=MID$(CL$,(I-1)*2+1,2):NEXT I
190 F$="D:"+FILE$+".PRN"
200 OPEN"I",1,F$
210 DIM D(50,41)
220 LINE INPUT #1,W$ 'BEGIN READING MASTER PRN FILE
230 LINE INPUT #1,W$
240 LINE INPUT #1,W$
250 LINE INPUT #1,W$
260 LINE INPUT #1,CY$
270 LINE INPUT #1,W$
280 STAR=(INSTR(CY$,"-")-11)/3
290 LCY=(LEN(CY$)-8)/3
300 IF STAR < LCY THEN LCY=STAR
310 PRINT:PRINT"COUNTRIES/REGIONS ARE:":PRINT
320 FOR I=1 TO LCY
330 CYM$(0,I)=MID$(CY$,(I-1)*3+10,2):PRINT CYM$(0,I);" ";:NEXT I:PRINT
340 LPR=0
350 PRINT:PRINT:PRINT"PRODUCT GROUPS ARE:":PRINT
360 LPR=LPR+1
```

```
370 LINE INPUT#1,W$
380 WP$=MID$(W$,5,4)
390 PBLANK=INSTR(WP$," "):IF PBLANK=0 THEN 410
400 WP$=RIGHT$(WP$,LEN(WP$)-1):GOTO 390
410 IF MID$(W$,7,2)=" ^" OR MID$(W$,7,2)="  " THEN 490 ELSE
PRM$(0,LPR)=WP$:PRINT PRM$(0,LPR);" ";
420 FOR J=1 TO LCY 'PUT ONE, TWO, THREE, FOUR OR ZERO IN D MATRIX FOR EACH ROW
430 X$=MID$(W$,(J-1)*3+9,3)
440 IF X$="  D" THEN X$="  2"
450 IF X$="  S" THEN X$="  3"
460 IF X$=" SD" OR X$=" DS" THEN X$="  4"
470 D(LPR,J)=VAL(X$):NEXT J
480 GOTO 360
490 CLOSE 1
500 LPR=LPR-1
510 PRINT:PRINT:INPUT"ENTER PRODUCT GROUP CODE";PR$
520 IF LEN(PR$)<>2 THEN 510
530 PRINT:PRINT"CONTINUING WITH ";PR$;" . . .":PRINT
540 OPEN"O",1,"D:TEST.BAT"
550 W$="ERASE D:"+NAMC$+PR$+".*":GOSUB 1850
560 W$="SC3 D:TEST":GOSUB 1850
570 W$="ERASE D:TEST.XQT":GOSUB 1850
580 W$="SDIR D:????^??.CAL":GOSUB 1850
590 CLOSE 1
600 FOR K=1 TO LPR
610 IF PR$=PRM$(0,K) THEN 630
620 NEXT K
630 PN=K
640 F$="D:TEST.XQT"
650 OPEN"O",1,F$ 'OPEN PRODUCT XQT FILE
660 PRINT:PRINT
670 W$="/GN":GOSUB 1850
680 KI$=STR$(8+2*LPR)
690 W$="/LD:"+NAM$+CYM$(0,LCY)+",PB"+KI$+":AZ"+KI$+",B1":GOSUB 1850
700 W$="=A1":GOSUB 1850
710 W$=NAMC$+PRM$(0,PN):GOSUB 1840
720 W$="/FR1,TR":GOSUB 1850
730 W$="/GM":GOSUB 1850
740 FOR K=1 TO LCY 'MAJOR LOOP TO LOAD EQUATIONS FOR EACH COUNTRY/REGION
750 PRINT CYM$(0,K);" ";
760 IF D(PN,K)=0 THEN 860 'IF PRODUCT NOT MODELED FOR COUNTRY, THEN SKIP
770 KI$=STR$(8+2*LPR)
780 W$="/LD:"+NAM$+CYM$(0,K)+",PA"+KI$+":A"+KI$+",A"+STR$(K+1):GOSUB 1850
790 KI$=STR$(PN+2*LPR+8) 'ROW LIFTED FROM COUNTRY DATA SET
800 W$="/LD:"+NAM$+CYM$(0,K)+",PB"+KI$+":M"+KI$+",B"+STR$(K+1)+",V":GOSUB 1850
'BASE DATA
810 W$="/LD:"+NAM$+CYM$(0,K)+",PN"+KI$+":S"+KI$+",N"+STR$(K+1):GOSUB 1850
'POLICIES
820 W$="/LD:"+NAM$+CYM$(0,K)+",PT"+KI$+":V"+KI$+",T"+STR$(K+1)+",V":GOSUB 1850
'CONSTANTS
830 W$="/LD:"+NAM$+CYM$(0,K)+",PW"+KI$+":X"+KI$+",W"+STR$(K+1):GOSUB 1850
'LIBERALIZED PRICE EQUATIONS
840 W$="/LD:"+NAM$+CYM$(0,K)+",PY"+KI$+":AB"+KI$+",Y"+STR$(K+1)+",V":GOSUB
1850 'CONSTANTS
850 W$="/LD:"+NAM$+CYM$(0,K)+",PAC"+KI$+":AZ"+KI$+",AC"+STR$(K+1):GOSUB 1850
```

```
'EQUATIONS AND INDICATORS
860 NEXT K
870 SL$=RIGHT$(STR$(LCY+3),LEN(STR$(LCY+3))-1) 'SOLUTION MECH. ROW
880 W$="/FR"+SL$+",TR":GOSUB 1850
890 W$="=G"+SL$:GOSUB 1850 'BEGIN CREATING WORLD MARKET CLEARING MECH.
900 W$="1":GOSUB 1850
910 FOR K=1 TO LCY:KI$=STR$(PN+2*LPR+8)
920 W$="/LD:"+NAM$+CYM$(0,K)+",PG"+KI$+":G"+KI$+",G"+SL$+",+":GOSUB 1850
930 NEXT K
940 X$="0":Y$="0":Z$="0":U$="0" 'WRITE BASE AVERAGE WORLD TRADE
950 FOR J=1 TO LCY:PS$=RIGHT$(STR$(J+1),LEN(STR$(J+1))-1)
960 IF J<12 THEN X$=X$+"+ABS(I"+PS$+")" ELSE GOTO 980
970 GOTO 1030
980 IF J<22 THEN Y$=Y$+"+ABS(I"+PS$+")" ELSE GOTO 1000
990 GOTO 1030
1000 IF J<32 THEN Z$=Z$+"+ABS(I"+PS$+")" ELSE GOTO 1020
1010 GOTO 1030
1020 U$=U$+"+ABS(I"+PS$+")"
1030 NEXT J
1040 W$="=I"+SL$:GOSUB 1850
1050 W$=X$:GOSUB 1840
1060 W$="=J"+SL$:GOSUB 1850
1070 W$=Y$:GOSUB 1840
1080 W$="=K"+SL$:GOSUB 1850
1090 W$=Z$:GOSUB 1840
1100 W$="=L"+SL$:GOSUB 1850
1110 W$=U$:GOSUB 1840
1120 W$="=M"+SL$:GOSUB 1850
1130 W$=CHR$(34)+"ABWDTRD":GOSUB 1840
1140 W$="=N"+SL$:GOSUB 1850
1150 W$="(I"+SL$+"+J"+SL$+"+K"+SL$+"+L"+SL$+")/2":GOSUB 1840
1160 X$="0":Y$="0":Z$="0":U$="0" 'WRITE BASE AVERAGE WORLD TRADE
1170 FOR J=1 TO LCY:PS$=RIGHT$(STR$(J+1),LEN(STR$(J+1))-1)
1180 IF J<12 THEN X$=X$+"+ABS(AE"+PS$+")" ELSE GOTO 1200
1190 GOTO 1250
1200 IF J<22 THEN Y$=Y$+"+ABS(AE"+PS$+")" ELSE GOTO 1220
1210 GOTO 1250
1220 IF J<32 THEN Z$=Z$+"+ABS(AE"+PS$+")" ELSE GOTO 1240
1230 GOTO 1250
1240 U$=U$+"+ABS(AE"+PS$+")"
1250 NEXT J
1260 W$="=P"+SL$:GOSUB 1850
1270 W$=X$:GOSUB 1840
1280 W$="=Q"+SL$:GOSUB 1850
1290 W$=Y$:GOSUB 1840
1300 W$="=R"+SL$:GOSUB 1850
1310 W$=Z$:GOSUB 1840
1320 W$="=S"+SL$:GOSUB 1850
1330 W$=U$:GOSUB 1840
1340 W$="=T"+SL$:GOSUB 1850
1350 W$=CHR$(34)+"ABWDTEQ":GOSUB 1840
1360 W$="=U"+SL$:GOSUB 1850
1370 W$="(P"+SL$+"+Q"+SL$+"+R"+SL$+"+S"+SL$+")/2":GOSUB 1840
1380 W$="=W"+SL$:GOSUB 1850
1390 W$=CHR$(34)+"WDTRADE%":GOSUB 1840
```

```
1400 W$="=X"+SL$:GOSUB 1850
1410 W$="/FE,$":GOSUB 1850
1420 W$="(U"+SL$+"-N"+SL$+")*100/N"+SL$:GOSUB 1840
1430 W$="=Y"+SL$:GOSUB 1850
1440 W$=CHR$(34)+"WDPRICE%":GOSUB 1840
1450 W$="=Z"+SL$:GOSUB 1850
1460 W$="/FE,$":GOSUB 1850
1470 W$="(AD"+SL$+"-AB"+SL$+")*100/AB"+SL$:GOSUB 1840
1480 W$="=AJ"+SL$:GOSUB 1850
1490 W$=CHR$(34)+"SUPDEM%":GOSUB 1840
1500 W$="=AK"+SL$:GOSUB 1850
1510 W$="/FE,$":GOSUB 1850
1520 W$="(SUM(AC1:AC"+STR$(LCY+1)+")-G"+SL$+")*100/G"+SL$:GOSUB 1840
1530 W$="=G"+SL$:GOSUB 1840
1540 W$="=AD"+SL$:GOSUB 1850
1550 W$="B"+STR$(1+LCY):GOSUB 1840
1560 W$="=AC"+SL$:GOSUB 1850
1570 W$=CHR$(34)+"LWDPRICE":GOSUB 1840
1580 W$="=AB"+SL$:GOSUB 1850
1590 W$="/CB"+STR$(1+LCY)+":B"+STR$(1+LCY)+",AB"+SL$:GOSUB 1840
1600 W$="=AA"+SL$:GOSUB 1850
1610 W$=CHR$(34)+"WDPRICE":GOSUB 1840
1620 W$="=AE"+SL$:GOSUB 1850
1630 W$="SUM(AE2:AE"+STR$(LCY+1)+")":GOSUB 1840
1640 W$="=AG"+SL$:GOSUB 1850
1650 W$=CHR$(34)+"DAMP.WT":GOSUB 1840
1660 W$="=AH"+SL$:GOSUB 1850
1670 W$="1":GOSUB 1840
1680 W$="=AI"+SL$:GOSUB 1850
1690 W$="AD"+SL$+"*(1-AH"+SL$+"*AE"+SL$+"/G"+SL$+")":GOSUB 1840
1700 FOR K=1 TO LCY
1710 W$="=B"+STR$(K+1):GOSUB 1850
1720 W$="/U":GOSUB 1850
1730 W$="AI"+SL$:GOSUB 1840
1740 NEXT K
1750 PRINT:PRINT
1760 W$="=A1":GOSUB 1850
1770 W$="!":GOSUB 1850
1780 W$="/SD:"+NAMC$+PRM$(0,PN)+",A":GOSUB 1850 'SAVE THE SPREADSHEET
1790 REM W$="/ODA1:AP"+SL$+",DD:"+NAMC$+PRM$(0,PN):GOSUB 1210
1800 W$="/Q,Y":GOSUB 1850
1810 CLOSE 1
1820 SYSTEM
1830 END
1840 PRINT #1,W$:PRINT #1,"/P":RETURN 'SAVE A STRING AND PROTECT A CELL
1850 PRINT #1,W$:RETURN 'SAVE A STRING
```

<u>WORLDMOD.BAT</u>

Give 4 letter name of master spreadsheet file (e.g. WORLDMOD DEMO).

```
SDIR D:%1-??.*
ERASE D:%1-WD.*
BASIC D:WORLD
SC3 D:TEST
```

```
ERASE D:TEST.XQT
SDIR D:%1-??.*
```

WORLD.BAS

```
10 REM - WORLD - CREATE WORLD PRODUCT MODEL SPREADSHEET FROM COUNTRY/REGION
SPREADSHEETS
20 REM COUNTRY/REGION SPREADSHEETS MUST HAVE PRICE AND QUANTITY BASE DATA
ADDED TO THEM BEFORE THIS PROGRAM IS RUN
30 CLS 'WORLD FILE IS CREATED FROM COUNTRY/REGION FILES
40 PRINT"PROGRAM TO CREATE A WORLD MULTI-REGION MULTI-PRODUCT MODEL FROM"
50 PRINT"COUNTRY/REGION SPREADSHEETS.  THE SPREADSHEETS MUST CONTAIN BASE"
60 PRINT"DATA, ELASTICITIES, AND EQUATIONS BEFORE THE WORLD MODEL IS"
70 PRINT"CREATED WITH THIS PROGRAM":PRINT
80 PRINT:INPUT"ENTER NAME OF MASTER FILE";FILE$
90 IF LEN(FILE$)<>4 THEN 30
100 NAM$=FILE$+"-"
110 PRINT:PRINT"READING MASTER FILE - ";FILE$:PRINT
120 DIM PRM$(0,122) 'MASTER FILE CAN CONTAIN UP TO 122 PRODUCT GROUPS
130 DIM CYM$(0,41) 'MASTER FILE CAN CONTAIN UP TO 41 COUNTRIES/REGIONS
140 CL$=" A B C D E F G H I J K L M N O P Q R S T U V W X Y
ZAAABACADAEAFAGAHAIAJAKALAMANAOAPAQARASATAUAVAWAXAYAZBABBBCBDBEBFBGBHBIBJBKBLB
MBNBOBPBQBRBSBTBUBVBWBXBYBZCACBCCCDCECFCGCHCICJCKCLCMCNCOCPCQCRCSCTCUCVCWCXCYC
ZDADBDCDDDEDFDGDHDIDJDKDLDMDNDODPDQDR"
150 LCL=LEN(CL$)/2
160 DIM CLM$(0,122)
170 FOR I=1 TO LCL '122 COLUMNS MAX.
180 CLM$(0,I)=MID$(CL$,(I-1)*2+1,2):NEXT I
190 F$="D:"+FILE$+".PRN"
200 OPEN"I",1,F$
210 DIM D(50,41)
220 LINE INPUT #1,W$ 'BEGIN READING TLIB.PRN MASTER FILE
230 LINE INPUT #1,W$
240 LINE INPUT #1,W$
250 LINE INPUT #1,W$
260 LINE INPUT #1,CY$
270 LINE INPUT #1,W$
280 STAR=(INSTR(CY$,"-")-11)/3
290 LCY=(LEN(CY$)-8)/3
300 IF STAR < LCY THEN LCY=STAR
310 PRINT:PRINT"COUNTRIES/REGIONS ARE:":PRINT
320 FOR I=1 TO LCY
330 CYM$(0,I)=MID$(CY$,(I-1)*3+10,2):PRINT CYM$(0,I);" ";:NEXT I:PRINT
340 LPR=0
350 PRINT:PRINT:PRINT"PRODUCT GROUPS ARE:":PRINT
360 LPR=LPR+1
370 LINE INPUT#1,W$
380 WP$=MID$(W$,5,4)
390 PBLANK=INSTR(WP$," "):IF PBLANK=0 THEN 410
400 WP$=RIGHT$(WP$,LEN(WP$)-1):GOTO 390
410 IF MID$(W$,7,2)=" ^" OR MID$(W$,7,2)="  " THEN 490 ELSE
PRM$(0,LPR)=WP$:PRINT PRM$(0,LPR);" ";
420 FOR J=1 TO LCY 'PUT ONE, TWO, THREE, FOUR OR ZERO IN D MATRIX FOR EACH ROW
430 X$=MID$(W$,(J-1)*3+9,3)
440 IF X$="  D" THEN X$="  2"
```

```
450 IF X$="  S" THEN X$="  3"
460 IF X$=" SD" OR X$=" DS" THEN X$="  4"
470 D(LPR,J)=VAL(X$):NEXT J
480 GOTO 360
490 CLOSE 1
500 LPR=LPR-1
510 PRINT:PRINT:INPUT"RIGHTMOST COLUMN INCLUDED (AZ IS DEFAULT)";RCOLUMN$
520 IF LEN(RCOLUMN$)<>2 THEN RCOLUMN$="AZ"
530 PRINT:PRINT"RIGHTMOST COLUMN IS ";RCOLUMN$
540 OPEN"O",1,"D:TEST.XQT"
550 W$="/GM":GOSUB 2620
560 W$="/GN":GOSUB 2620
570 FOR K=1 TO LCY 'LOOP TO ADD EACH COUNTRY/REGION FILE TO WORLD FILE
580 KP=(K-1)*(LPR+5)+1 'POSITION FOR EACH NEW FILE ADDED
590 DB$=STR$(KP+1)
600 DE$=STR$(KP+5+2*LPR)
610 W$="/LD:"+NAM$+CYM$(0,K)+",PA1:S200,A"+STR$(KP):GOSUB 2620 'LOAD BASE DATA
620 W$="/LD:"+NAM$+CYM$(0,K)+",PT1:V200,T"+STR$(KP)+",V":GOSUB 2620 'LOAD
PRICE LINKAGE EQUATION CONSTANTS
630 W$="/LD:"+NAM$+CYM$(0,K)+",PW1:Z200,W"+STR$(KP):GOSUB 2620 'LOAD PRICE
LINKAGE EQUATIONS
640 W$="/LD:"+NAM$+CYM$(0,K)+",PAA1:AB200,AA"+STR$(KP)+",V":GOSUB 2620 'LOAD
EQUATION CONSTANTS
650 W$="/LD:"+NAM$+CYM$(0,K)+",PAC1:"+RCOLUMN$+"200,AC"+STR$(KP):GOSUB 2620
'LOAD EQUATIONS
660 W$="/UA"+DB$+":AZ"+DE$:GOSUB 2620 'DELETE ELASTICITY MATRICES
670 W$="/DR"+DB$+":"+DE$:GOSUB 2620
680 W$="=A"+STR$(KP):GOSUB 2620
690 W$="/FR,,TL":GOSUB 2620
700 W$="=A1":GOSUB 2620
710 NEXT K
720 KP=LCY*(LPR+5)+1
730 KPP=(LCY-1)*(LPR+5)+1
740 W$="=V"+STR$(KP):GOSUB 2620
750 W$=CHR$(34)+"WDTRD1":GOSUB 2610
760 W$="=W"+STR$(KP):GOSUB 2620
770 W$=CHR$(34)+"WDTRD2":GOSUB 2610
780 W$="=AE"+STR$(KP):GOSUB 2620
790 W$=CHR$(34)+"WDTRADE":GOSUB 2610
800 W$="/CA"+STR$(KPP+2)+":B"+STR$(KPP+LPR+3)+",A"+STR$(KP):GOSUB 2620
810 W$="/CA"+STR$(KPP+3)+":A"+STR$(KPP+LPR+3)+",AB"+STR$(KP+1):GOSUB 2620
820 W$="=A"+STR$(KP):GOSUB 2620
830 W$="/U":GOSUB 2620
840 W$=NAM$+"WD":GOSUB 2610
850 W$="=AB"+STR$(KP):GOSUB 2620
860 W$=NAM$+"WD":GOSUB 2610
870 W$="=E"+STR$(KP):GOSUB 2620
880 W$=CHR$(34)+"SUPDWD1":GOSUB 2610
890 W$="=F"+STR$(KP):GOSUB 2620
900 W$=CHR$(34)+"SUPDWD2":GOSUB 2610
910 W$="=G"+STR$(KP):GOSUB 2620
920 W$=CHR$(34)+"SUPDEMWD":GOSUB 2610
930 W$="=I"+STR$(KP):GOSUB 2620
940 W$=CHR$(34)+"ABWDTRD1":GOSUB 2610
950 W$="=J"+STR$(KP):GOSUB 2620
```

```
960 W$=CHR$(34)+"ABWDTRD2":GOSUB 2610
970 W$="=K"+STR$(KP):GOSUB 2620
980 W$=CHR$(34)+"ABWDTRD3":GOSUB 2610
990 W$="=L"+STR$(KP):GOSUB 2620
1000 W$=CHR$(34)+"ABWDTRD4":GOSUB 2610
1010 W$="=N"+STR$(KP):GOSUB 2620
1020 W$=CHR$(34)+"ABWDTRD":GOSUB 2610
1030 W$="=T"+STR$(KP):GOSUB 2620
1040 W$=CHR$(34)+"SUPDEQ1":GOSUB 2610
1050 W$="=U"+STR$(KP):GOSUB 2620
1060 W$=CHR$(34)+"SUPDEQ2":GOSUB 2610
1070 W$="=AC"+STR$(KP):GOSUB 2620
1080 W$=CHR$(34)+"SUPDEMEQ":GOSUB 2610
1090 W$="=AD"+STR$(KP):GOSUB 2620
1100 W$=CHR$(34)+"WDPRICE":GOSUB 2610
1110 W$="=X"+STR$(KP):GOSUB 2620
1120 W$=CHR$(34)+"ABSWDTD1":GOSUB 2610
1130 W$="=Y"+STR$(KP):GOSUB 2620
1140 W$=CHR$(34)+"ABSWDTD2":GOSUB 2610
1150 W$="=Z"+STR$(KP):GOSUB 2620
1160 W$=CHR$(34)+"ABSWDTD3":GOSUB 2610
1170 W$="=AA"+STR$(KP):GOSUB 2620
1180 W$=CHR$(34)+"ABSWDTD4":GOSUB 2610
1190 W$="=AF"+STR$(KP):GOSUB 2620
1200 W$=CHR$(34)+"ABSWDTRD":GOSUB 2610
1210 W$="=AG"+STR$(KP):GOSUB 2620
1220 W$=CHR$(34)+"WEIGHT":GOSUB 2610
1230 W$="=AH"+STR$(KP):GOSUB 2620
1240 W$=CHR$(34)+"LWDPRICE":GOSUB 2610
1250 W$="=AI"+STR$(KP):GOSUB 2620
1260 W$=CHR$(34)+"SUPDEM%":GOSUB 2610
1270 W$="=AJ"+STR$(KP):GOSUB 2620
1280 W$=CHR$(34)+"WDPRICED":GOSUB 2610
1290 W$="=AK"+STR$(KP):GOSUB 2620
1300 W$=CHR$(34)+"WDPRICE%":GOSUB 2610
1310 W$="=AL"+STR$(KP):GOSUB 2620
1320 W$=CHR$(34)+"WDTRADE%":GOSUB 2610
1330 FOR I=1 TO LPR 'CREATE WORLD TRADE BASE (AVERAGE VALUE)
1340 X$="0":Y$="0":Z$="0":U$="0"
1350 FOR J=1 TO LCY:JP=(J-1)*(LPR+5)+3:PS$=RIGHT$(STR$(JP+I),LEN(STR$(JP+I))-
1)
1360 IF D(I,J)=0 THEN 1440
1370 IF J<12 THEN X$=X$+"+ABS(I"+PS$+")" ELSE 1390
1380 GOTO 1440
1390 IF J<22 THEN Y$=Y$+"+ABS(I"+PS$+")" ELSE 1410
1400 GOTO 1440
1410 IF J<32 THEN Z$=Z$+"+ABS(I"+PS$+")" ELSE 1430
1420 GOTO 1440
1430 U$=U$+"+ABS(I"+PS$+")"
1440 NEXT J
1450 W$="=I"+STR$(KP+I):GOSUB 2620
1460 W$=X$:GOSUB 2610
1470 W$="=J"+STR$(KP+I):GOSUB 2620
1480 W$=Y$:GOSUB 2610
1490 W$="=K"+STR$(KP+I):GOSUB 2620
```

```
1500 W$=Z$:GOSUB 2610
1510 W$="=L"+STR$(KP+I):GOSUB 2620
1520 W$=U$:GOSUB 2610
1530 W$="=N"+STR$(KP+I):GOSUB 2620
1540
W$="(I"+STR$(KP+I)+"+J"+STR$(KP+I)+"+K"+STR$(KP+I)+"+L"+STR$(KP+I)+")/2":GOSUB
2610
1550 NEXT I
1560 FOR I=1 TO LPR 'CREATE WORLD TRADE SUM
1570 X$="0":Y$="0"
1580 FOR J=1 TO LCY:JP=(J-1)*(LPR+5)+3:PS$=RIGHT$(STR$(JP+I),LEN(STR$(JP+I))-
1)
1590 IF D(I,J)=0 THEN 1610
1600 IF J<21 THEN X$=X$+"+AE"+PS$ ELSE Y$=Y$+"+AE"+PS$
1610 NEXT J
1620 W$="=V"+STR$(KP+I):GOSUB 2620
1630 W$=X$:GOSUB 2610
1640 W$="=W"+STR$(KP+I):GOSUB 2620
1650 W$=Y$:GOSUB 2610
1660 W$="=AE"+STR$(KP+I):GOSUB 2620
1670 W$="0+V"+STR$(KP+I)+"+W"+STR$(KP+I):GOSUB 2610
1680 NEXT I
1690 FOR I=1 TO LPR 'CREATE BASE SUPPLY=DEMAND SUM
1700 X$="0":Y$="0"
1710 FOR J=1 TO LCY:JP=(J-1)*(LPR+5)+3:PS$=RIGHT$(STR$(JP+I),LEN(STR$(JP+I))-
1)
1720 IF D(I,J)=0 THEN 1740
1730 IF J<21 THEN X$=X$+"+G"+PS$ ELSE Y$=Y$+"+G"+PS$
1740 NEXT J
1750 W$="=E"+STR$(KP+I):GOSUB 2620
1760 W$=X$:GOSUB 2610
1770 W$="=F"+STR$(KP+I):GOSUB 2620
1780 W$=Y$:GOSUB 2610
1790 W$="=G"+STR$(KP+I):GOSUB 2620
1800 W$="E"+STR$(KP+I)+"+F"+STR$(KP+I):GOSUB 2610
1810 NEXT I
1820 FOR I=1 TO LPR 'CREATE SUPPLY EQUATION SUM FOR WORLD
1830 X$="0":Y$="0"
1840 FOR J=1 TO LCY:JP=(J-1)*(LPR+5)+3:PS$=RIGHT$(STR$(JP+I),LEN(STR$(JP+I))-
1)
1850 IF D(I,J)=0 THEN 1870
1860 IF J<21 THEN X$=X$+"+AC"+PS$ ELSE Y$=Y$+"+AC"+PS$
1870 NEXT J
1880 W$="=T"+STR$(KP+I):GOSUB 2620
1890 W$=X$:GOSUB 2610
1900 W$="=U"+STR$(KP+I):GOSUB 2620
1910 W$=Y$:GOSUB 2610
1920 W$="=AC"+STR$(KP+I):GOSUB 2620
1930 W$="T"+STR$(KP+I)+"+U"+STR$(KP+I):GOSUB 2610
1940 NEXT I
1950 FOR I=1 TO LPR 'CREATE SUM OF ABSOLUTE VALUE OF TRADE FOR WORLD
1960 X$="0":Y$="0":Z$="0":U$="0"
1970 FOR J=1 TO LCY:JP=(J-1)*(LPR+5)+3:PS$=RIGHT$(STR$(JP+I),LEN(STR$(JP+I))-
1)
1980 IF D(I,J)=0 THEN 2060
```

```
1990 IF J<12 THEN X$=X$+"+ABS(AE"+PS$+")" ELSE GOTO 2010
2000 GOTO 2060
2010 IF J<22 THEN Y$=Y$+"+ABS(AE"+PS$+")" ELSE GOTO 2030
2020 GOTO 2060
2030 IF J<32 THEN Z$=Z$+"+ABS(AE"+PS$+")" ELSE GOTO 2050
2040 GOTO 2060
2050 U$=U$+"+ABS(AE"+PS$+")"
2060 NEXT J
2070 W$="=X"+STR$(KP+I):GOSUB 2620
2080 W$=X$:GOSUB 2610
2090 W$="=Y"+STR$(KP+I):GOSUB 2620
2100 W$=Y$:GOSUB 2610
2110 W$="=Z"+STR$(KP+I):GOSUB 2620
2120 W$=Z$:GOSUB 2610
2130 W$="=AA"+STR$(KP+I):GOSUB 2620
2140 W$=U$:GOSUB 2610
2150 W$="=AF"+STR$(KP+I):GOSUB 2620
2160
W$="(X"+STR$(KP+I)+"+Y"+STR$(KP+I)+"+Z"+STR$(KP+I)+"+AA"+STR$(KP+I)+")/2":GOSU
B 2610
2170 NEXT I
2180 FOR I=1 TO LPR 'CREATE WORLD MARKET CLEARING MECHANISM
2190 KP$=RIGHT$(STR$(KP+I),LEN(STR$(KP+I))-1)
2200 W$="/CB"+STR$(KPP+I+2)+":B"+STR$(KPP+I+2)+",AD"+KP$:GOSUB 2620 'COPY IN
WDPRICES
2210 W$="=AD"+KP$:GOSUB 2620
2220 W$="/U":GOSUB 2620
2230 W$="=AG"+KP$:GOSUB 2620 'WEIGHTS
2240 W$="1":GOSUB 2610
2250 W$="=AH"+KP$:GOSUB 2620 'NEW WORLD PRICE
2260 W$="AD"+KP$+"*(1-AG"+KP$+"*AE"+KP$+"/AC"+KP$+")":GOSUB 2620
2270 W$="/FE,$":GOSUB 2610
2280 W$="=AI"+KP$:GOSUB 2620 'ADD SUPPLY=DEMAND % CHANGE FROM BASE
2290 W$="(AC"+KP$+"-G"+KP$+")*100/G"+KP$:GOSUB 2620
2300 W$="/FE,$":GOSUB 2610
2310 W$="=AJ"+KP$:GOSUB 2620
2320 W$="AH"+KP$+"-B"+KP$:GOSUB 2620
2330 W$="/FE,$":GOSUB 2610
2340 W$="=AK"+KP$:GOSUB 2620
2350 W$="AJ"+KP$+"*100/B"+KP$:GOSUB 2620
2360 W$="/FE,$":GOSUB 2610
2370 W$="=AL"+KP$:GOSUB 2620
2380 W$="(AF"+KP$+"-N"+KP$+")*100/N"+KP$:GOSUB 2620
2390 W$="/FE,$":GOSUB 2610
2400 FOR J=1 TO LCY 'PUT WORLD PRICES IN COUNTRY/REGION ROWS
2410 JP=(J-1)*(LPR+5)+3:PS$=RIGHT$(STR$(JP+I),LEN(STR$(JP+I))-1)
2420 W$="=B"+PS$:GOSUB 2620
2430 W$="/U":GOSUB 2620
2440 W$="AD"+KP$:GOSUB 2620
2450 W$="/FE,$":GOSUB 2610
2460 NEXT J
2470 W$="=AD"+KP$:GOSUB 2620
2480 W$="AH"+KP$:GOSUB 2620
2490 W$="/FE,$":GOSUB 2610
2500 NEXT I
```

```
2510 W$="/FGTR":GOSUB 2620
2520 PRINT:PRINT
2530 W$="=AB"+STR$(KP):GOSUB 2620
2540 REM W$="!":GOSUB 1600
2550 W$="/SD:"+NAM$+"WD,A":GOSUB 2620 'SAVE THE SPREADSHEET
2560 REM W$="/ODA1:AP"+STR$(KP+LPR+4)+",DD:"+NAM$+"WD":GOSUB 1600
2570 W$="/Q,Y":GOSUB 2620
2580 CLOSE 1
2590 SYSTEM
2600 END
2610 PRINT #1,W$:PRINT #1,"/P":RETURN 'SAVE A STRING AND PROTECT A CELL
2620 PRINT #1,W$:RETURN 'SAVE A STRING
```

AGCTY.BAT

```
BASIC D:AGCTY
SC3 D:TEST
ERASE D:TEST.XQT
```

AGCTY.BAS

```
10 REM - AGCTY - AGGREGATE ACROSS COUNTRY/REGION DATA SHEETS
20 REM COUNTRY/REGION SPREADSHEETS
30 CLS 'AGGREGATE SELECTED PARTS OF COUNTRY/REGION FILES
40 PRINT:PRINT"PROGRAM TO AGGREGATE SELECTED PARTS OF COUNTRY/REGION SHEETS"
50 PRINT:INPUT"ENTER NAME OF MASTER FILE";FILE$
60 NAM$=FILE$+"-"
70 IF LEN(FILE$)<>4 THEN 30
80 PRINT:PRINT"READING MASTER FILE - ";FILE$:PRINT
90 DIM PRM$(0,122) 'MASTER FILE CAN CONTAIN UP TO 122 PRODUCT GROUPS
100 DIM CYM$(0,41) 'MASTER FILE CAN CONTAIN UP TO 41 COUNTRIES/REGIONS
110 CL$=" A B C D E F G H I J K L M N O P Q R S T U V W X Y
ZAAABACADAEAFAGAHAIAJAKALAMANAOAPAQARASATAUAVAWAXAYAZBABBBCBDBEBFBGBHBIBJBKBLB
MBNBOBPBQBRBSBTBUBVBWBXBYBZCACBCCCDCECFCGCHCICJCKCLCMCNCOCPCQCRCSCTCUCVCWCXCYC
ZDADBDCDDDEDFDGDHDIDJDKDLDMDNDODPDQDR"
120 LCL=LEN(CL$)/2
130 DIM CLM$(0,122)
140 FOR I=1 TO LCL '122 COLUMNS MAX.
150 CLM$(0,I)=MID$(CL$,(I-1)*2+1,2):NEXT I
160 F$="D:"+FILE$+".PRN"
170 OPEN"I",1,F$
180 DIM D(50,41)
190 LINE INPUT #1,W$ 'BEGIN READING TLIB.PRN MASTER FILE
200 LINE INPUT #1,W$
210 LINE INPUT #1,W$
220 LINE INPUT #1,W$
230 LINE INPUT #1,CY$
240 LINE INPUT #1,W$
250 STAR=(INSTR(CY$,"-")-11)/3
260 LCY=(LEN(CY$)-8)/3
270 IF STAR < LCY THEN LCY=STAR
280 FOR I=1 TO LCY
290 CYM$(0,I)=MID$(CY$,(I-1)*3+10,2):NEXT I
300 LPR=0
310 PRINT:PRINT"PRODUCT GROUPS ARE:":PRINT
```

```
320 LPR=LPR+1
330 LINE INPUT#1,W$
340 WP$=MID$(W$,5,4)
350 PBLANK=INSTR(WP$," "):IF PBLANK=0 THEN 370
360 WP$=RIGHT$(WP$,LEN(WP$)-1):GOTO 350
370 IF MID$(W$,7,2)=" ^" OR MID$(W$,7,2)="  " THEN 450 ELSE
PRM$(0,LPR)=WP$:PRINT PRM$(0,LPR);" ";
380 FOR J=1 TO LCY 'PUT ONE, TWO, THREE, FOUR OR ZERO IN D MATRIX FOR EACH ROW
390 X$=MID$(W$,(J-1)*3+9,3)
400 IF X$="  D" THEN X$="  2"
410 IF X$="  S" THEN X$="  3"
420 IF X$=" SD" OR X$=" DS" THEN X$="  4"
430 D(LPR,J)=VAL(X$):NEXT J
440 GOTO 320
450 PRINT:CLOSE 1:LPR=LPR-1:DIM RCY$(0,51):IR=0
460 CLS:PRINT:PRINT"POSSIBLE COUNTRIES/REGIONS ARE:":PRINT
470 FOR I=1 TO LCY:PRINT CYM$(0,I);" ";:NEXT I:PRINT
480 PRINT:PRINT"INCLUDED SO FAR:";:FOR K=1 TO IR:PRINT " ";RCY$(0,K);:NEXT
K:PRINT
490 PRINT:INPUT"ENTER 2 DIGIT COUNTRY/REGION CODE TO BE IN AGGREGATED ('ENTER'
TO QUIT)";RRCY$
500 IF RRCY$="  " OR LEN(RRCY$)=0 THEN 590
510 FOR JC=1 TO LCY 'COUNTRY/REGION IS PEGGED AND CHECKED
520 IF RRCY$=CYM$(0,JC) THEN 550
530 NEXT JC
540 GOTO 460
550 FOR K=1 TO IR:IF RRCY$=RCY$(0,K) THEN 460
560 NEXT K
570 IR=IR+1:RCY$(0,IR)=RRCY$
580 GOTO 460
590 PRINT:PRINT"ADD CELL RANGE":PRINT:PRINT:INPUT"TOP LEFT CELL COLUMN
(LETTER) OF BLOCK TO BE ADDED";TLCOL$
600 INPUT"TOP LEFT CELL ROW (NUMBER) OF BLOCK TO BE ADDED";TLROW$
610 PRINT:INPUT"BOTTON RIGHT CELL COLUMN (LETTER) OF BLOCK TO BE ADDED";BRCOL$
620 INPUT"BOTTON RIGHT CELL ROW (NUMBER) OF BLOCK TO BE ADDED";BRROW$
630 PRINT:PRINT"HOW MANY COLUMNS FROM ";TLCOL$;" TO ";BRCOL$;:INPUT COLNUM
640 TL$=TLCOL$+TLROW$:BR$=BRCOL$+BRROW$
650 PRINT:PRINT"IS BLOCK ";TL$;":";BR$;" (";COLNUM;" COLUMNS) OKAY (Y OR N)";
660 INPUT Y$:IF Y$="N" THEN 590
670 OPEN"O",1,"D:TEST.XQT"
680 W$="/GN":GOSUB 850
690 COL$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
700 ROWNUM=VAL(BRROW$)-VAL(TLROW$)+1
710 W$="/LD:"+NAM$+"RW"+",PA"+TLROW$+":A"+BRROW$+",A1":GOSUB 850
720 FOR R=1 TO ROWNUM:FOR C=1 TO COLNUM
730 W$="="+MID$(COL$,C+1,1)+STR$(R):GOSUB 850
740 W$="0":GOSUB 850
750 NEXT C,R
760 W$="=A1":GOSUB 850
770 FOR I=1 TO IR
780 W$="/LD:"+NAM$+RCY$(0,I)+",P"+TL$+":"+BR$+",B1,+":GOSUB 850
790 W$="/UA1:Z500":GOSUB 850
800 NEXT I
810 W$="=A1":GOSUB 850
820 CLOSE 1
```

```
830 SYSTEM
840 END
850 PRINT #1,W$:RETURN
```

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